EVERYTHING ABOUT GREENHOUSE

Digitized by

ASSOCIATION
FOR
PRESERVATION
TECHNOLOGY,
INTERNATIONAL
www.apti.org

BUILDING
TECHNOLOGY
HERITAGE
LIBRARY

https://archive.org/details/buildingtechnologyheritagelibrary

From the collection of:

Alan O'Bright

5 00

EVERYTHING FOR THE GREENHOUSE

JOHN C. MONINGER CO.
CHICAGO, U. S. A.
ESTABLISHED 1868

GENERAL OFFICE AND WORKS

JOHN C. MONINGER COMPANY, CHICAGO, ILL.

Ground space over four acres. Six Buildings with floor space of over 100,000 square feet.
Daily capacity, 10 Greenhouses 27x100 feet.

FOREWORD

LIKE a great many things in this world, this book is the result of a dream. Like the building of a Skyscraper, the Panama Canal, the Keokuk Dam, the Eiffel Tower and a great many things too numerous to mention, there first had to be a dream before it could come about. So for many years it was our dream, some day to get out a complete catalogue that would really cover **everything for the greenhouse.**

It is a pleasure for us to send out these books and with each of them we send at the same time, our best wishes to you. You will appreciate the book we are sure and some day we hope you will find it useful.

You will find us ready to take care of your orders at all times. If you are not in need of any material today, you will need something tomorrow. If you are having trouble of any kind in your greenhouse work, write us about it and we will try to help you. We will appreciate any inquiry you send us and will try to answer your questions in a way that will do you some good. We want to count you among our friends. We want to make things pleasant for everyone in the trade and if there is anything we can do for you, whether you are a customer or not, let us know about it.

In this way, in a few words, we have tried to explain our position and show our appreciation for the many thousands of dollars the florists have spent with us and our appreciation for the many pleasant associations we have had during the forty-five years this company has been in business.

Yours very truly,

JOHN C. MONINGER CO.

Chicago, August 8, 1913.

A VISIT TO OUR WORKS AT CHICAGO

WHETHER you have a green house or not; whether you own a large range or a small one; or if you are only thinking of some day building or purchasing greenhouse materials, it is important, for several reasons, that you should know something about the making of this class of goods. In the first place if you know that your material is made in a large, up-to-date modern factory you feel that you are dealing with a first-class firm and one that has enough capital and backing to make good their claims and promises. Then, too, the size of the factory indicates that the product manufactured is being purchased by a large number of people, which is further proof of the honesty and reliability of the firm. It also shows that the company is prepared to handle your order from start to finish in a proper manner and you feel sure of getting what you order.

The first detail in any business is the handling of the mail. The accompanying view shows the part of our office where this work is done. Thousands of inquiries are received here asking for information about greenhouses; how to build; what to build; cost of it; how to heat; kind of boiler to use; and a hundred and one other things too numerous to mention.

We are always willing to give any information we can on greenhouse subjects and your letter will be answered promptly and carefully. In this department the billing and accounting is taken care of and in another part of the office not shown in this view the purchasing department is located. The buying of material for a large plant like ours requires the undivided time of an expert purchasing agent and assistants. By employing special men to do our buying we are able to get low prices and in turn give you the benefit of this service many times by quoting you figures below the market. In this way it happens that you can get your glass, pipe, woodwork, steel framework, and other materials from us for less money, quality and everything considered of course, than you can elsewhere.

To properly build a green house, plans must be made and material manufactured from them. These plans are of such a character and the line of construction of such a technical nature that it is necessary for us to employ draftsmen and teach them to make the plans in our own office. About six months' time is generally required in which to even partly learn the making of the plans and become familiar with the construction. The plans that we make are very carefully drawn and, being made as they are under the direct supervision of our experts on construction, are correct in form and detail so they can be easily followed.

In this view the main part of our architectural department is shown. This is the second floor of our office building and of course it receives the benefit of air and light. Our force of draftsmen is probably the largest of any firm in this line of business, and we get out sketches and drawings very rapidly. With every bid we submit a blue print plan of the house on which we are figuring, so that construction and estimate immediately becomes intelligible to you. In another part of this room a model house is set up composed of various paterns that we make so that the actual work can be examined from time to time by the draftsmen, and it is also of service in illustrating the work to customers. The

President of the company has his office on this floor and personally looks after the work and makes suggestions regarding special construction, etc. The office of the Secretary and Treasurer of the company is on the first floor in the main office. On each floor large and spacious fire-proof vaults have been built and all correspondence, plans and working materials are placed in them every night so in case of fire everything will be preserved and the work carried right ahead as soon as the records can be taken out.

From the office building to the lumber yards is but a few steps and the sight of the immense stock of cypress is certainly one that you will remember. In no other manufacturing plant or retail lumber yard in the United States will you find such a stock of this high grade of cypress. The view here shows one of the alleys in the main yard. There are 10 of these alleys in this yard, and there are three other smaller yards filled with cypress.

The amount of money that must be invested in cypress in this business is very great, running into many thousands of dollars, and without a large capital all the different lengths and sizes required to make greenhouse material cannot be carried. For this reason we are able to ship quickly as we always have the lumber on hand By keeping a large stock the lumber can be purchased to much better advantage than it can a carload at a time, for when we find a nice lot of lumber at any mill we buy it at a good price and put it in our yard. When you are much in need of a car you must take what you can get at any price, whether it is dry or not. We dry our lumber in our own yards and we know that it is perfect before it enters our factory.

From the yards the rough lumber is taken to large planers and dressed on both sides so that all defects, such as sap, knots, etc., will become readily

apparent. The boards are then turned over to our inspector and as they are brought to the saws to be ripped into sizes each piece is carefully looked over and marked. In this picture the inspector is shown examining a board as it goes to the saw. This insures you against sappy or defective material but another inspection is made after the material is manufactured, and again before shipping, so there is no possibility of mistake in this regard.

After being ripped on the saws to proper size the pieces are placed back of the various machines to be run into ridges, bars, purlins, gutters, sills, etc.

The next view shows one of the large gutter machines being used in our plant.

This machine is built after our own designs and has special parts for this class of work. The ordinary machinery used in planing mills is not as efficient as the special machines that we have built for the purpose and do not turn out the same smooth, high grade of work. It is important that woodwork be made smooth and well machined, for this saves time in painting and you need less paint than otherwise. Money saved, you know, is money earned and when good smooth well made material costs no more than that which is rough and poorly made why not have the best. The cut here shows a view on the first floor of the factory where there is a line of woodworking machines in operation.

Many operations must be gone through with in the manufacture of even the smallest greenhouse and in addition to the ripping, inspecting, forming the patterns, making of special knives, etc., the various pieces must be sorted so that only perfect ones will be used. The sash bars go from the molding machines to a special saw with double blades where the ends are cut to fit the proper bevel at the ridge or at the eave line. Then

the patterns for ridge, gutter, eaves plate, glass sill, purlin, wall coping, etc., must be made into runs according to the length of the house.

This cut shows one of the splicing machines that makes the now famous lock splice. This splice when pieces are set together firmly locks the parts together and it makes a joint that cannot be otherwise than just right. This is only a little point we are bringing out here but it is important, and many little things like this go to make up the perfect construction and the perfect house. The machine shown is one we had built for the work and cuts off the end of material and splices it all in one operation. It is a perfect machine and does its work accurately. Coming from the first floor to the second you enter the sash and door department. Here the thousands of ventilators, hot bed sash and doors are made. Machinery is up-to-date and the men up to the minute. Here is where extreme care is necessary—in the making of the

sash. You will find this part of the work very interesting for before a sash is completed many operations must be gone through. Some of the interesting things are, an automatic accurate marker for marking the places to be punched or bored, an automatic mortiser that works with a steel gauge so that each bar in every sash is absolutely the right distance apart; a compound clamp and dowelling machine that forms and nails the sash perfectly square; and special machines for making doors, hot bed sash and odd ventilators.

In addition to factory space for woodworking, room must be provided for storage. The picture here shows part of our several storage rooms. An electric elevator of large size is installed in this building so that long lengths of lumber on trucks can be handled from one floor to another. Carloads of glass are unloaded and placed in this room and we are always prepared to fill orders immediately. This is only one more detail but it shows that we can furnish the house complete and that we actually carry in stock the material we sell. No waiting, no delay.

After leaving the storage rooms you come into building "D" in which is carried the enormous stock of pipe, structural steel, boilers, valves, fittings, ventilating apparatus and in which is located the drill presses, punch presses, pipe cutting and threading machines, and other iron working machinery. This building is five stories high and approximately 100 feet square, making a total floor space of 50,000 square feet. From 10 to 15 carloads of pipe is always carried on hand so that orders can be sent off at once. The stock includes both wrought steel and genuine wrought iron. Black and galvanized pipe are carried as well as the spellerized and the extra heavy. You ought to know about our pipe business and get figures from us. Not only do we carry the wrought pipe but a full stock of cast iron as well. This cast iron pipe is used by many florists for hot water systems and if properly handled it makes a fairly good job. Joints are packed with oakum and Portland cement, no threads or threaded fittings being necessary. In addition to the pipe we have all of the cast iron fittings for this class of work so you can get the system complete in one place. When you get into the screwed line of fittings, however, you find an almost unlimited number of sizes and patterns and much space is required for the rows of bins in which to store them. The picture at top of next page shows some of these bins and gives a little idea of the room they take up and the quantity of goods we have in stock. Our line includes everything needed for either steam or hot water heating and all fittings, valves, etc., used for watering systems. In addition, rubber hose, hose goods, screws, nails, hardware, etc., are carried here. The amount of money invested is enormous but to give a customer the right service when he purchases a complete house it is better to have the goods in stock. We don't go out and buy the stuff after we get the order but we ship it right from our factory direct to you. The same things that apply to all of our other materials also apply to the celebrated MONINGER BOILER about which you have heard and read so much. No greenhouse boiler on the market today can lay claim to a record as wonderful as the one this boiler has achieved. There is no guesswork about our boiler for it is the most prominent green-

house boiler on the market, heating as it does over 25,000,000 square feet of glass. It is a boiler that starts to work immediately as soon at it gets on the job and it don't make a fuss over it either. It is a boiler that burns but little fuel, needs practically no cleaning and lasts a life time. There is no brick work to be done and no bridge wall to build. The boiler is shipped you all ready for business and all you have to do is to set it up. Every part is made so accurate and so perfect that anybody can put it together. It is not too heavy and two men can do the job. Here are two men placing one of the sections in position. Look at the deep, roomy fire pot and the large flue ways—the very appearance of the boiler is encouraging, especially to the man who has put in the long hard winters with a monster flue boiler and has laid awake nights thinking how to keep the houses from freezing. You will never know what a pleasure a cast iron boiler is until you get one and learn how to run it. You can then lie down at night and sleep in peace.

In our boiler department a large number of sections of the different sizes are always carried in stock so that boilers of various capacities can be made up on short notice. This department is in charge of a competent "boiler man" who thoroughly understands the making up of headers, pipe cutting for mains, fitting of sections, arrangement of tappings, etc. It is here that boilers are set up and twinned. Everything for a battery of boilers is put together perfectly, every piece marked plainly and then shipped to you ready to assemble. This makes pipe fitting of boiler headers an easy matter for those who do not have a pipe shop handy. Batteries are made up for plants as large as 200,000 square feet of glass. You ought to have our engineer talk with you and learn more about our boilers. Let us tell you what a really wonderful greenhouse heater it is.

The last thing we want to show you is our shipping room, or part of it rather, for it is so arranged that only part of it can be photographed. This room is so situated that wagons and cars can be loaded with little trouble and there is room enough to take care of 20 freight cars and four wagons at one time. All woodwork is packed here with great care and placed in piles, each order separate, just as it comes from the machines. Additional space is provided on the second floor for packing sash and doors, which are brought down on a large electric elevator. The ironwork, pipe, heating materials and the boilers are loaded from building "D" but all shipping papers are made out here by an expert shipping clerk who thoroughly understands routing, railway classifications, freight tariffs, casing rules, etc.

We pride ourselves on our shipping and packing department and it is an important part of the business. After a large amount of time, labor and money is spent to make perfect material we feel that it is proper to see that it is just as perfectly packed and crated for shipment so that damage in transit is reduced to a minimum. You will like our method of packing and shipping. All carload freight is well braced in the cars and then sealed under our private seals. You are practically sure of the safe arrival of the goods if shipped by us.

From office to yards, from yards to factory, through six buildings you have followed us and we are only sorry that we could not show you a hundred and one other very interesting details of this business. We are sorry, too, that it was not a personal visit you were paying but we hope some day to have that pleasure. Anyway we believe you are convinced of the fact that we are ready for you when you build a greenhouse, and that we can fill your order the way it ought to be filled. Place the next contract in our hands and you'll never regret it.

Having become familiar with our manufacturing methods, we are sure you will be interested in the finished product shown on the following pages.

A few places we have furnished

The following pages will give you an idea of the extent of our business. Houses in every state in the union.

Owned by Frederick Fair, Oil City, Pa.

Whether it is a little house 10x20 feet like our standard size shown above or a large expensive layout like the one below you will find we can handle the job and do it right.

Owned by J. E. Tilt, Chicago.

MONINGER HOUSES IN ILLINOIS

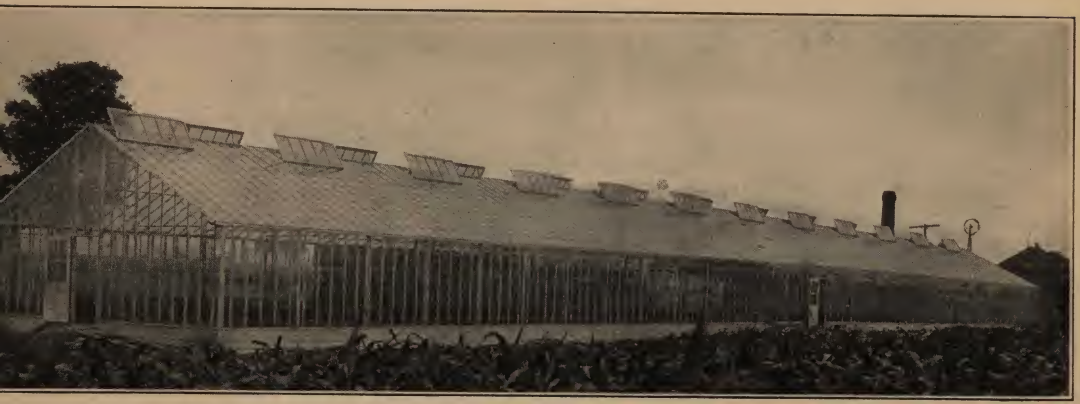
Iron Frame Flat Rafter.

Bassett & Washburn's new range—five houses, 34x600 feet. A model range designed by us in our forty-fifth year of experience. Built at Greggs Station, Ill. Owned by Bassett & Washburn, 131 N. Wabash Ave., Chicago, Ill.

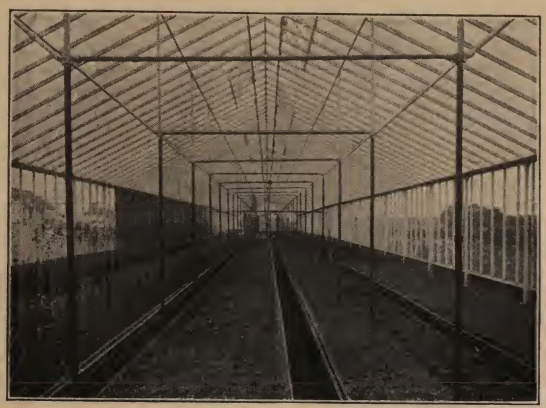
34x400 feet semi-iron house. Used for cucumbers. Owned by Geo. G. Whitcomb, Streator, Ill.

Streator, Illinois.

Illinois—Continued



Semi-iron house built for Walter Burhop, Maywood, Ill.



Interior.

Width 28 feet 9 inches.

Length 200 feet.

Walls 8 feet.

Benches are solid 12 in. high.

Crops grown are sweet peas and carnations.

Steam heated.

Interior Showing Our Double "Y" Arch.

Double Y and arch construction for semi-iron houses. A strong type of framing.

Illinois—Continued

Iron frame and truss house in course of construction at the University of Chicago, Chicago, Ill. Size of this house 34x120 feet. Moninger high pressure steam heating system. For entomology department in charge of Prof. Tower.

Other houses at the University of Chicago, Chicago, Ill., botany department.

Illinois—Continued

View From Top of Boiler Shed.

The Wendland & Keimel plant at Elmhurst, Ill. Houses in this view 27x200. Semi-iron. New addition 34x200. Flat rafter houses.

Roses grown exclusively.

Trussed iron frame type.

Three houses 28x133.

Used for carnations.

Moninger steam heating system—low pressure.

Gus. Swanson, owner, River Forest, Ill.

Illinois—Continued

Third largest plant in the world. Wieter Bros., Chicago, Ill. 27 foot semi-iron houses.

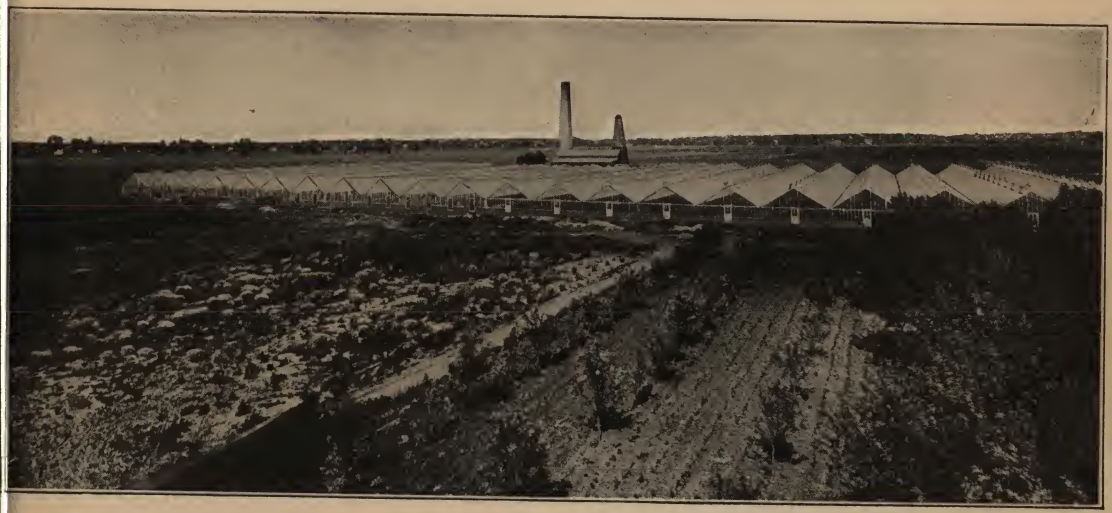
Interior of a 60-foot flat rafter house at the J. E. Tilt place in Chicago. Finest and largest private greenhouse in the west.

Illinois—Continued

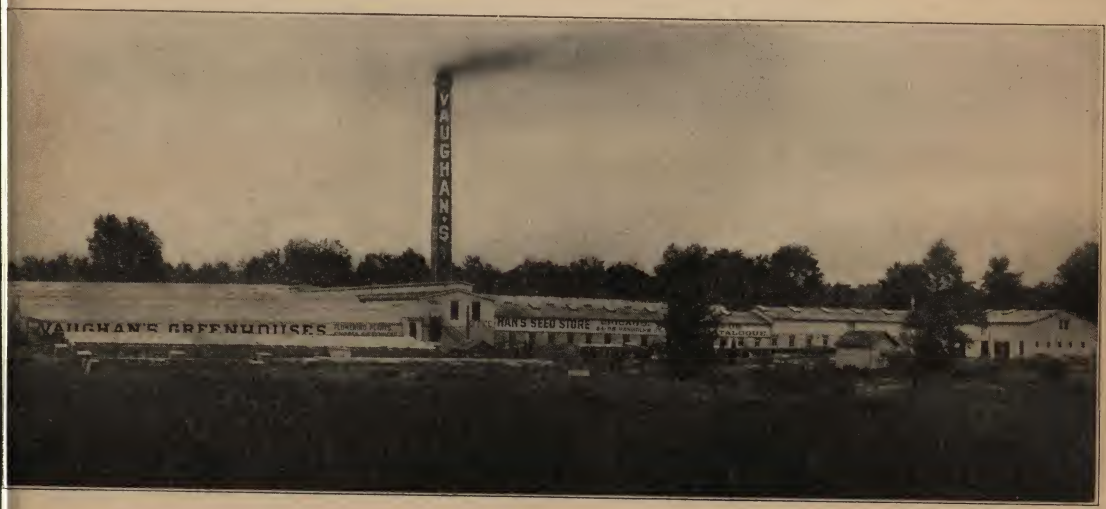
The famous Poehlmann Bros. range at Morton Grove, Ill. Largest modern plant in the world. Houses are all 27 feet wide. Semi-iron construction.

A vegetable range owned by Peter Weiss, Glenview, Ill. Houses are 27x150 semi-iron. Crops are lettuce, radishes and cucumbers.

Illinois—Continued



Hoerber Bros., Des Plaines, Ill. Another range of semi-iron houses. 27 feet wide and 200 feet long. General line of cut flowers.



The greenhouse end of Vaughan's Seed Store, Chicago, Ill. Houses located at Western Springs, Ill.

MONINGER IRON FRAME SERVICE BUILDING

This type of building is just the thing for commercial plants. It is strong, light and economical. The one shown here is 25 feet wide and 100 feet long. The entire space is open and free to use as desired. Let us figure on your next service building.

Notice each walk has its own door. The end walk in the greenhouse is saved and each bench is two feet longer than it would otherwise be. These doors are cheap, being made out of pecky cypress bench lumber.

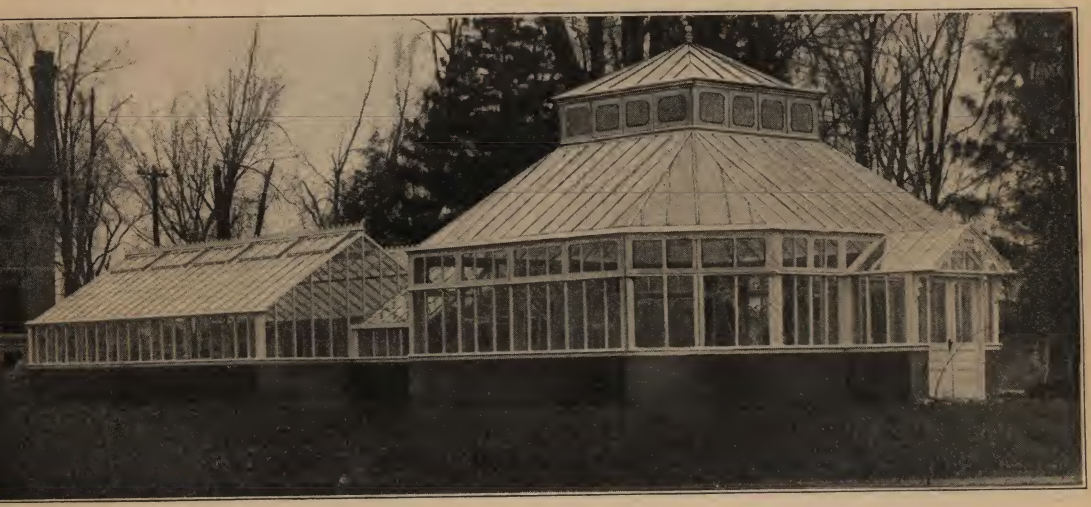
Illinois—Continued

Samuel J. Pearce, Chicago, Ill.

This is the famous bulb grower you have heard so much about. This plant is entirely new and modern. There is a total of 46,000 square feet of glass. The entire plant is built of Moninger material and heated with our high presssure hot water system. This is the acme of semi-iron construction and one of the best ranges for the money in the United States. Total cost erected, $20,000.

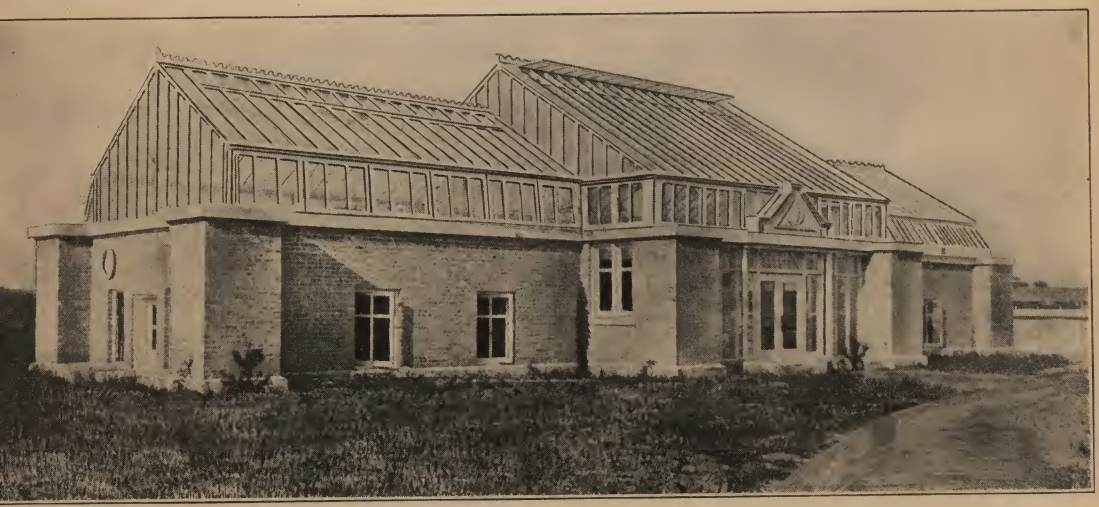
Our iron frame boiler shed is the thing you want.

Illinois—Continued



Illinois State Normal School, Normal, Ill.

Two layouts here showing wide difference in greenhouse architectural style. These houses suited to private estates as well.



Northern Illinois State Normal School, De Kalb, Ill.

This lower cut shows class room building below and greenhouses above. An ideal arrangement for schools.

Illinois—Continued

Waldheim Cemetery Company, Forest Park, Ill.

A square, hipped roof show house that adds considerable to the attractiveness of a range of ordinary growing houses. Moderate in cost.

Bohemian National Cemetery, Chicago, Ill.

A more attractive style of show house. Costs a little more than the type above but is still reasonable enough for most anyone who has need for a building of this kind.

Illinois

(Concluded)

Stores with the greenhouse attached. Ideas for the fellow that retails and produces some of his stock.

H. N. Bruns, Chicago, Ill.

Henry L. Seitz, Chicago, Ill.

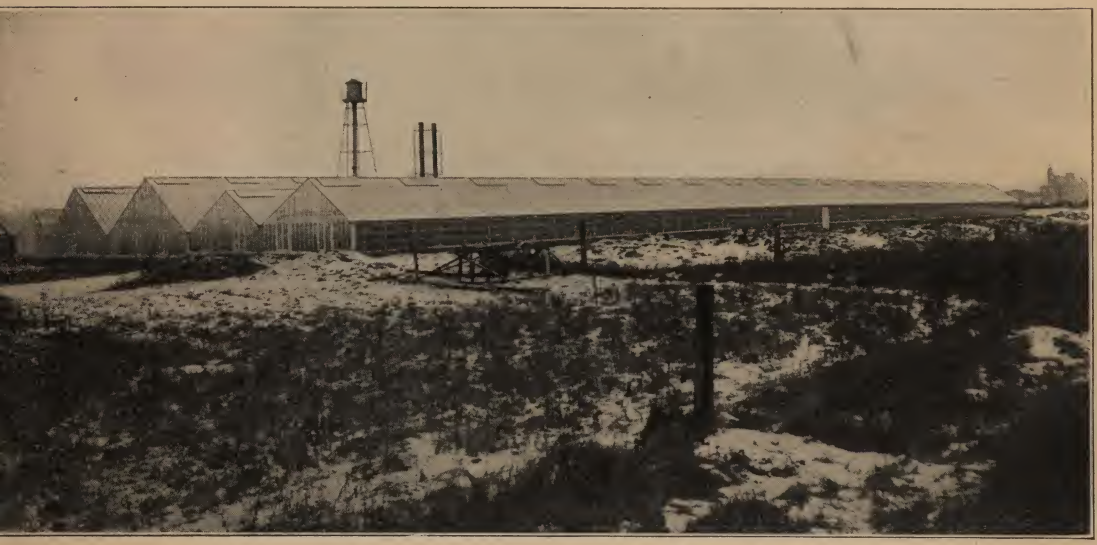
E. Weinhoeber Co., Chicago, Ill.

Iowa

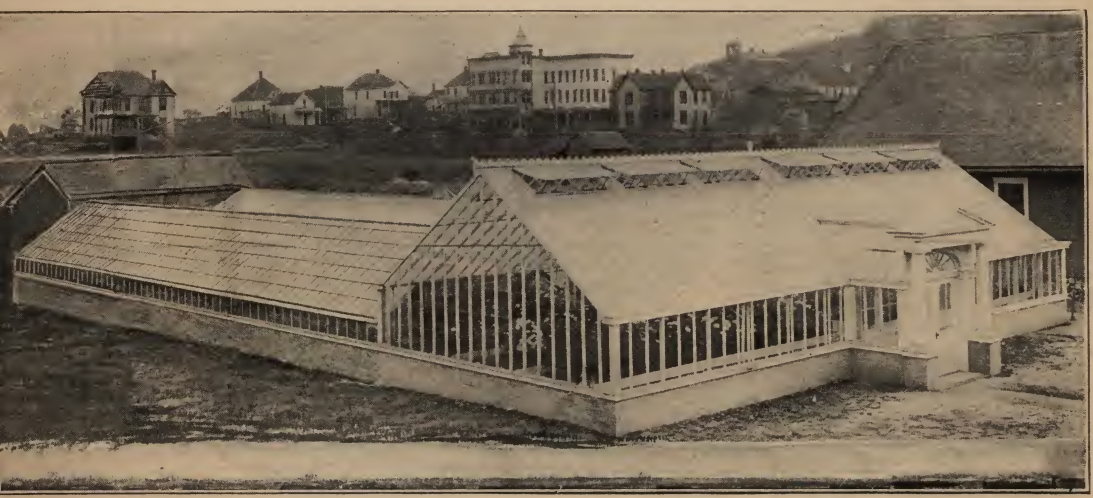
A modern plant at Osage, Iowa, owner by Walter S. Hall. Central part used as showhouse and salesroom. Good idea.

The well-known Wilcox place at Council Bluffs, Iowa. About 600,000 square feet of glass. Owned by J. F. Wilcox & Sons. Largest range west of Chicago.

Indiana



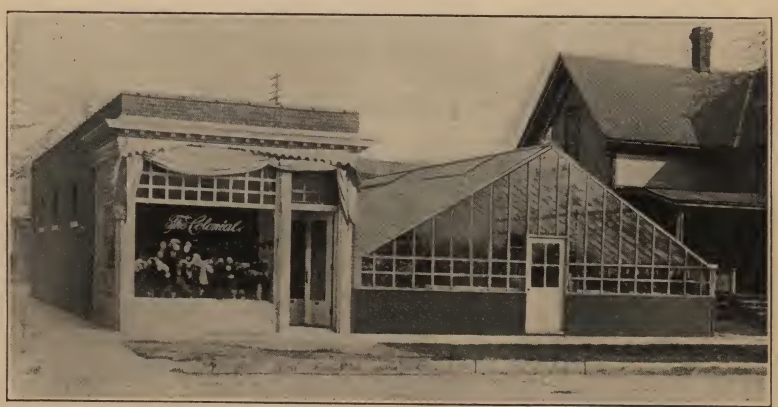
The Smith & Young range at Indianapolis, Ind. Used for cut flowers. Semi-iron houses.



A pleasing style of house used by French Lick Springs Hotel Co. at French Lick, Ind. The vestibule entrances is a feature of this range.

Indiana—Continued

A range of 22 vegetable houses owned by John G. Frisz of Vincennes, Ind. Hot water heating. Semi-iron houses.



The Colonial Flower Shop, Goshen, Ind.

An inexpensive and pleasing greenhouse and store combination. This is just it for the retailer.

Ohio

Fifth Avenue Floral Co., Columbus, Ohio.

Fred Ruetenik, Cleveland, Ohio.

This State is dotted everywhere with Moninger Houses. In Cleveland alone there are 34 greenhouse owners using our material. Space prevents our showing a large number of places we would like to have you see.

Write us for the name of your nearest neighbor with a Moninger House. You will find him a satisfied customer and a successful grower.

Elms Greenhouses, Girard, Ohio.

Ohio—Continued

This modern range of trussed iron frame houses is located at Winton Place, Cincinnati, Ohio, and was built by Otto Hirschfeld, 4736 Edgewood Ave. Size 34x150. Hot water heat.

All heating is placed on the walls and are painted with our Metal-Kote paint. If you get near Cincinnati, call up Mr. Hirschfeld and he will show you around.

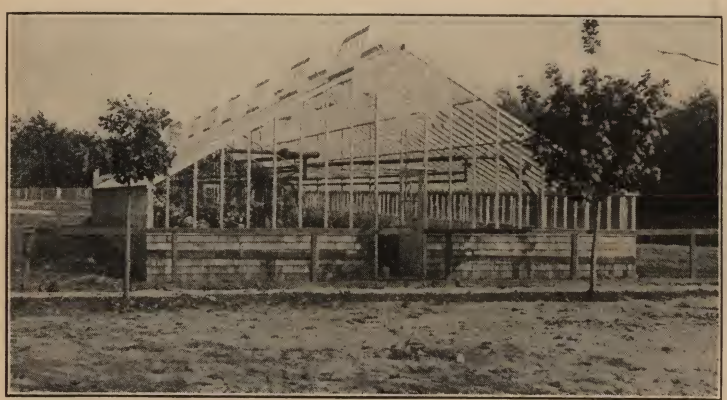
New York

Jos. Cervenka, East Islip, L. I., N. Y.

Semi-iron Houses. Hot water heat.

There are two houses in this range. First one is shown below. Long Island has alone about twenty Moninger houses.

Freight costs are low and you can buy in Chicago for less than in New York.



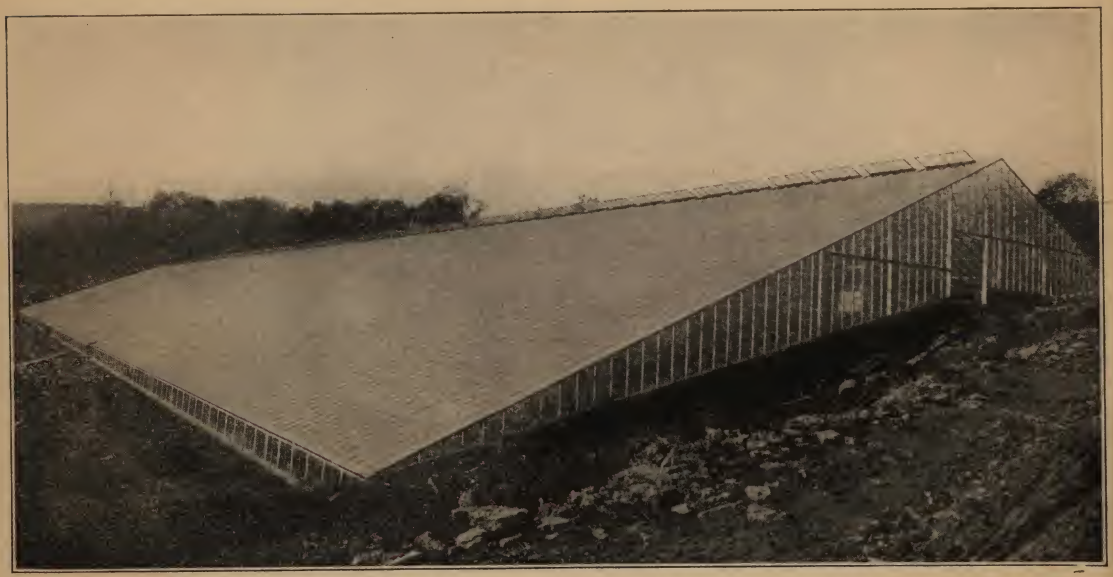
Connecticut and Massachusetts

The Wm. Pinchbeck place at Ridgefield, Conn. Hot water heat. Semi-iron construction. Grows cut flowers.

C. H. Lothrop, Lexington, Mass.

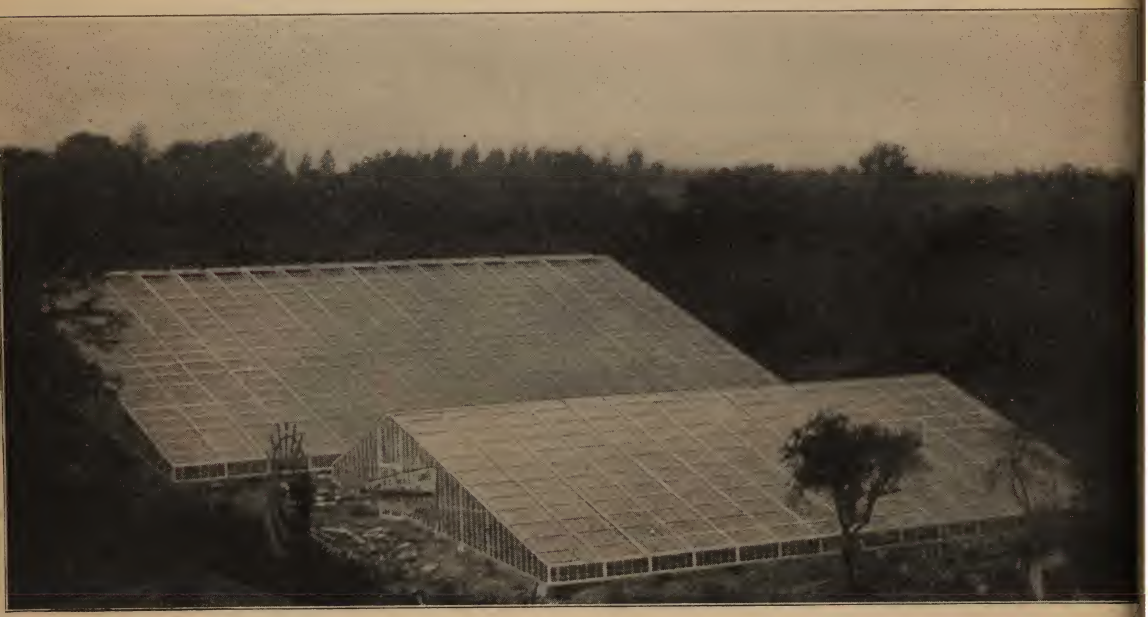
Here is the first house for the man in a small town. A neat and inexpensive workroom attached with boiler set in the basement. A place like this can be built for a small amount of money. The house is heated with a Moninger hot water boiler and piping system.

Pennsylvania



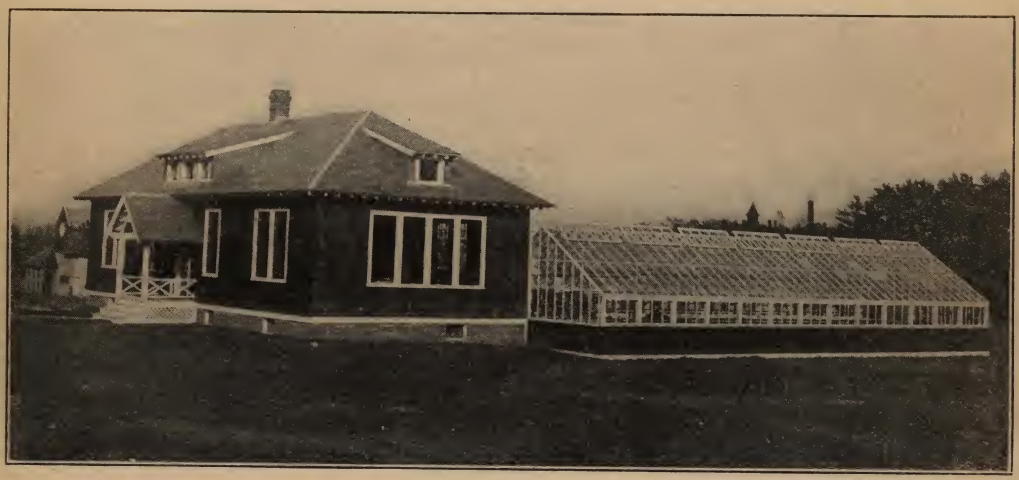
The largest vegetable greenhouse in the world.

Semi-iron construction owned by W. H. Weinschenk, New Castle, Pa. Width 120 feet, length 600 feet. Stock planted on the ground.



Flat rafter houses owned by Weinschenk & George, New Castle, Pa. 125 feet wide. Heated with Moninger boilers. Steam system.

Vermont



University of Vermont, Burlington, Vt.

There are 3 houses 20 feet wide and 60 feet long. Used for experimental purposes and in class work. An ideal university layout that is inexpensive.

Service building is of frame construction with shingled sides and stone foundation. Boiler located in basement. Low pressure Moninger steam heating system.

Kentucky

John P. Fister & Bros., Lexington, Ky .

Vegetable Houses.. Planting done on the ground. Several other houses in Lexington and throughout the state. Ask for the names.

University of Kentucky, Lexington, Ky.

A little different arrangement of palm house and growing houses. Let us have your idea and we will design something for you.

District of Columbia

United States Government, Department of Agriculture, Washington, D. C.

These Houses are of various sizes and are of several types. The Government is constantly delving into all kinds of plant growth and investigating plant diseases.

United States Government, Department of Agriculture, Washington, D. C.

A competent force of engineers is in charge of the range and their numerous bullétin reports are of great benefit to the greenhouse owner.

Western States

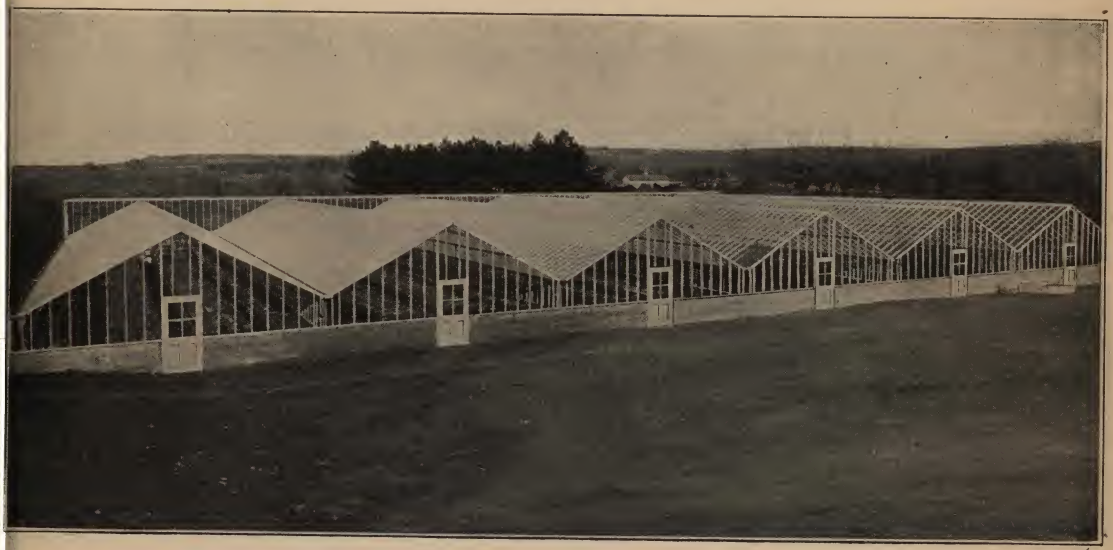
Salt Lake Floral Co., Salt Lake City, Utah.

Semi-iron houses 300 feet long. Four houses 21 feet wide and six 27 feet wide. For cut flowers and vegetables.

Miller Floral Co., Farmington, Utah.

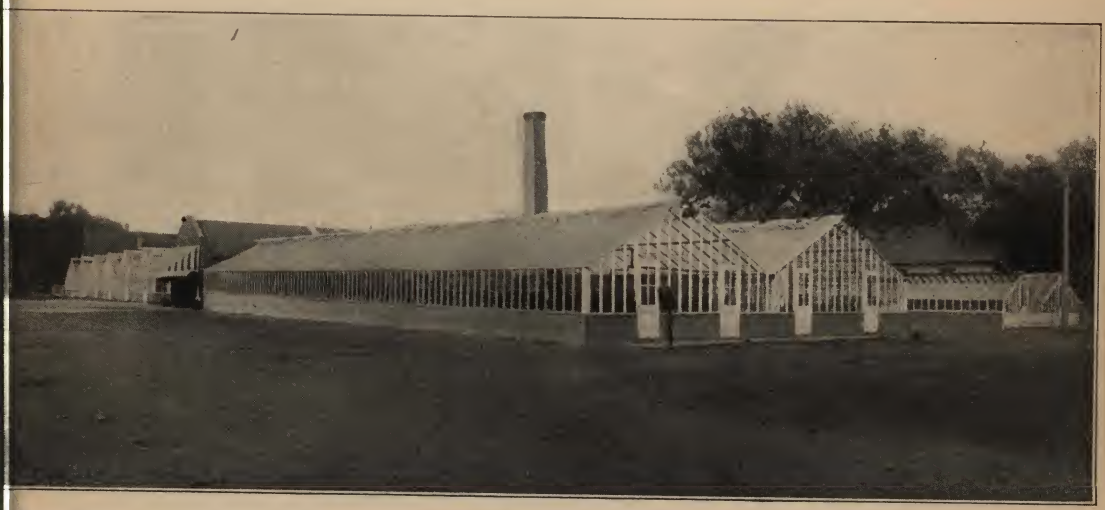
The most modern range west of the Missouri river. Semi-iron construction. Principal crop is roses. Heated by steam. Houses 300 feet long.

Western States—Continued



Kansas State Agricultural College, Manhattan, Kansas.

Six houses, 27x125, with propagating house across the ends. Semi-iron construction. A neat, well built range suitable for cut flowers or vegetables.



Byron H. Ives, Albuquerque, New Mexico.

This plant located in a city of about 7,000. Semi-iron type. Width 27 feet. Various lengths from 125 feet to 250 feet. Two houses in front are 27x125 feet.

Western States—Continued

Hess & Swoboda, Omaha, Neb.

Semi-iron houses. Commercial range growing almost everything in the cut flower line. Owners operate city store and do a large shipping business.

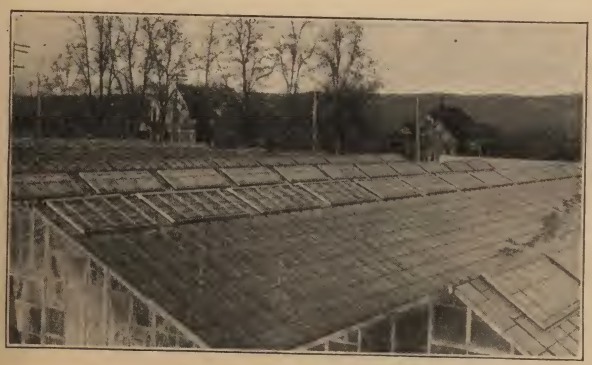
C. H. Frey, Lincoln, Neb.

Just beyond Omaha is this commercial range of about 26 houses. All semi-iron type and used for cut flowers.

Western States—Continued

Brenner Floral Co., Shawnee, Okla.

Palms house with two wings for show houses. Growing houses in the rear. Approximate cost of this plant $10,000.00.



Boise Floral Co., Boise, Idaho.

It costs a great deal of money to ship goods from Chicago to Idaho but it pays in the end to build Moninger houses.

Boise Floral Co., Boise, Idaho.

Good houses produce good stock and do away with all worry and trouble.

Western States—Continued

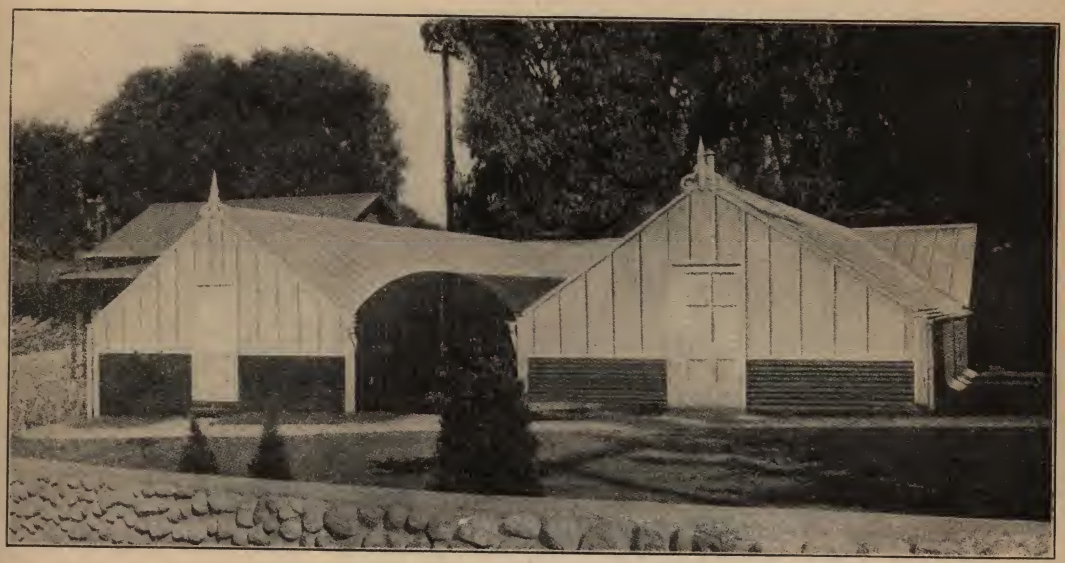
Butte Floral Co., Butte, Mont.

Here is a range of semi-iron and iron frame houses. The last addition is our 34 foot standard type iron frame and truss. Heated by steam.

Walla Walla Hot House Vegetable Co., Walla Walla, Wash.

The short roof type for a commercial range is in use here. This plant is one of the largest on the Pacific Coast. All semi-iron houses.

Western States—Continued



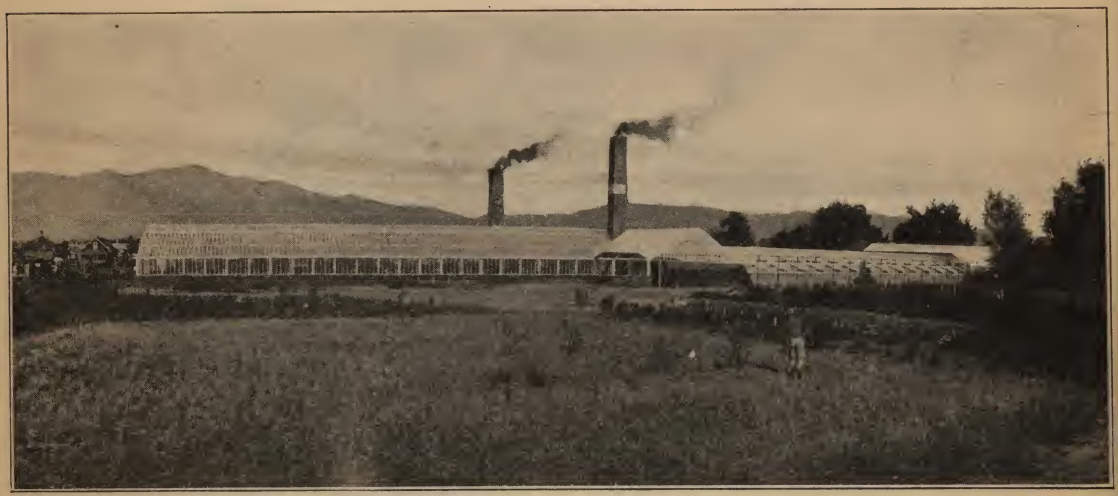
Dr. Rudolph Schiffmann, Pasadena, Cal.

These houses are used for orchids, of which Dr. Schiffmann has a large collection. Heated by our hot water system. Semi-iron construction. All woodwork is cypress.

University of Arizona, Tucson, Ariz.

These houses have been in use several years and Director R. H. Forbes says they give entire satisfaction. Moninger Boilers are used and houses are heated with both hot water and steam.

Western States—Continued

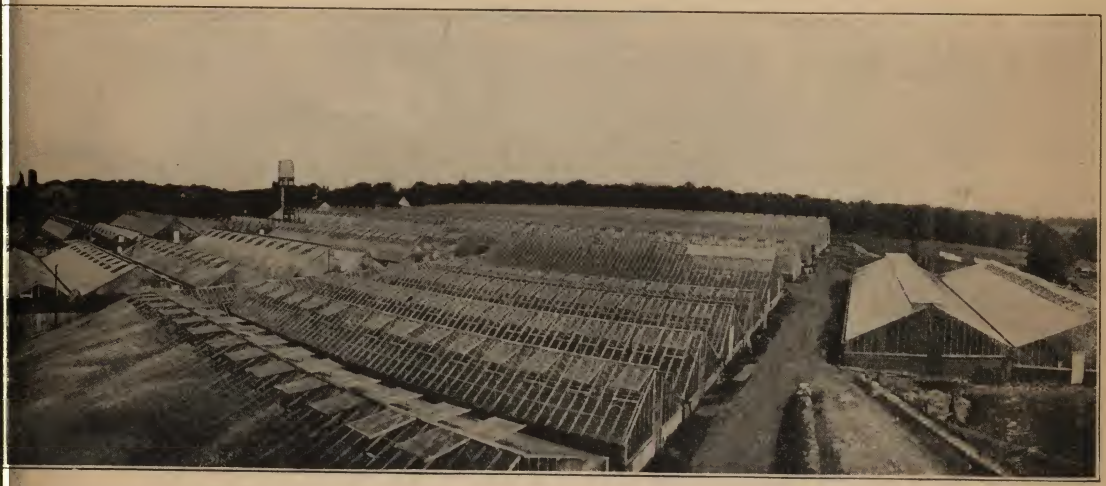


Pikes Peak Floral Co., Colorado Springs, Colo.

A cut flower range of modern semi-iron houses. Steam heating system. The second largest range in Colorado.

The Park Floral Co. at Denver is a consolidation of two firms, the other being the Colfax Avenue concern. The largest plant in Colorado. Mr. Valentine of this company is an ex-president of the S. A. F.

Southern States



Joy Floral Co., Nashville, Tenn.

Largest range south of the Ohio river. Later houses are 27 feet wide Semi-iron construction. Heated with steam.

Wm. L. Rock Flower Co., Kansas City, Mo.

This big new range is a show place for visitors. Ten houses, 27x300, of semi-iron construction, used for cut flowers.

Southern States—Continued

Texas Seed & Plant Co., Dallas, Texas.

Another cut flower range just outside a large city. Company operates a store at 219 Elm street. Surplus stock is shipped out into the state.

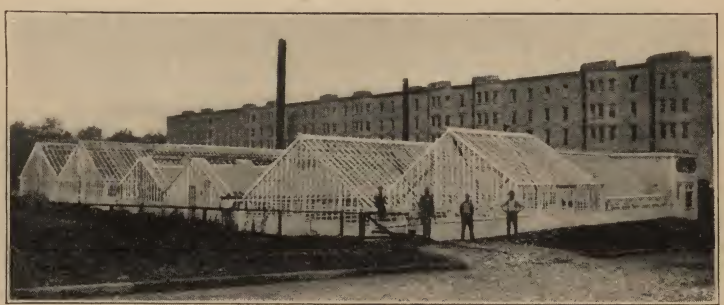
Metairie Ridge Nursery Co., New Orleans, La.

Houses, 27x200, of semi-iron construction. Cut flower range. Owners operate a large nursery and have retail store in the city.

Southern States—Continued

Stuppy Floral Co., St. Joseph, Mo.

A range of houses on a hillside. Later buildings are of semi-iron construction and 27 feet wide. Used for cut flowers for shipping trade and for retail store. An addition has been built every year for several years.



Lake Newell Floral Co., Lake Newell, W. Va.

A new range built in 1911-1912. Houses of several sizes are used as company grows specialties. About 100,000 square feet of glass in this range.

Northern States

Holton & Hunkel Greenhouse Co., Milwaukee, Wis.

This is the largest range in the state and one of the largest in the country. Partly iron frame and partly semi-iron houses. New 1913 addition, connecting with first house in the view above, consists of six houses 27 x400 feet.

Interior of a 34 foot flat rafter house, showing method of supporting the roof, general construction, etc.

Northern States—Continued

Geo. Vatter, Marinettte, Wis.

A northern cut flower range. Stock grown for retail store. Semi-iron construction. Heated by hot water. Boiler room located on the north end.

Clinton Falls Nursery Co., Owatonna, Minn.

Another nursery company in the cut flower business. Two detached rose houses, 34x150, and seven connected houses for carnations and general stock.

Northern States—Continued

The Mitchell Greenhouse and Nurseries, Mitchell, S. D.

Semi-iron houses used for cut flowers and general stock. Product sold in their retail store. Steam heating system.

Chas. Frueh & Sons, Saginaw, Mich.

This picture does not do justice to the range this company owns. A general line of stock is grown. One of the largest ranges in the State.

Canada

Frache Bros., Lethbridge, Alta, Canada.

Four houses, 34x200, of semi-iron construction. New modern houses, built in 1913. Used for a general line of stock. Moninger greenhouses are rapidly multiplying in Canada.

One of the tomato houses owned by E. J. F. Coster, Prince Albert, Sask., Canada. Semi-iron. Heated by hot water. In this country the grower is confronted with weather conditions that are very trying. The temperature range is extreme and the changes are often and sudden.

Conservatories

Conservatory owned by R. S. Kirchberger, Highland Park, Ill.
Iron frame curved eave construction.

Three Types For Your Home

Straight Roof Lean-to.

Even Span, Standard Stock Size, 10x20 Feet.

Curved Roof Conservatory and Workroom Attached.

Semi-Iron Houses

STANDARD TYPES

Now and then somebody rises to remark that the iron frame houses are no more economical than the semi-iron type with upright supports for the roof. This comes very near to being the truth and when you consider the cost of materials for the houses, together with the durability, it's a mighty hard house to beat.

You will find there is really very little difference in the quality of the stock and the quantity is the same.

The upright supports are not so much in the way as one would think. Sometimes we really think they are a convenience more than a hindrance.

If you want the most for your money at the start try the semi-iron house.

There are exceptions to this in extra wide houses.

These houses may be built in any width desired, but we recommend the standard sizes as shown here. Special widths cost no more money as far as materials are concerned except that special widths make it necessary to often miscut lumber and there is more waste to pay for. Standard types for this reason cost a little less.

When writing for estimates be sure to tell us your plan in detail. The more information you give us the better we will be able to help you and the more accurate our estimate will be. We are always glad to submit figures and plans.

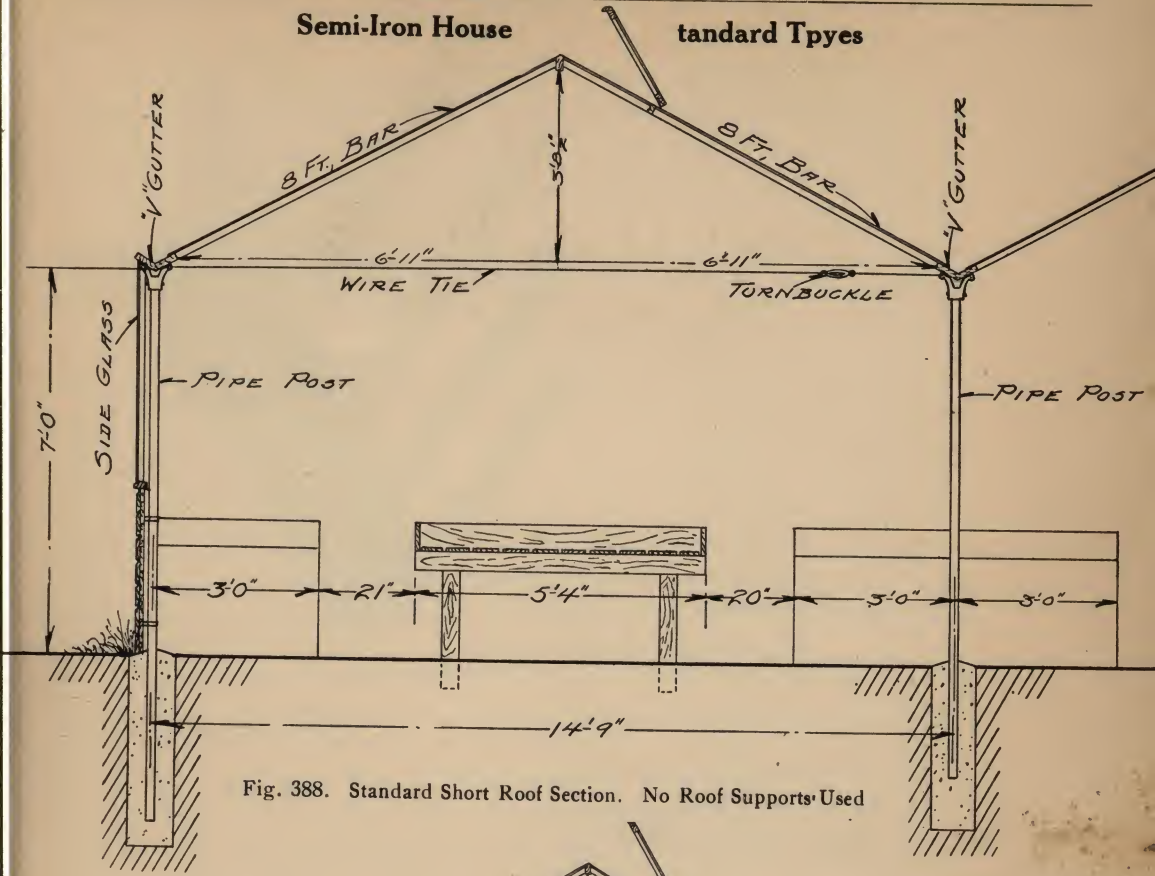


Fig. 388. Standard Short Roof Section. No Roof Supports Used

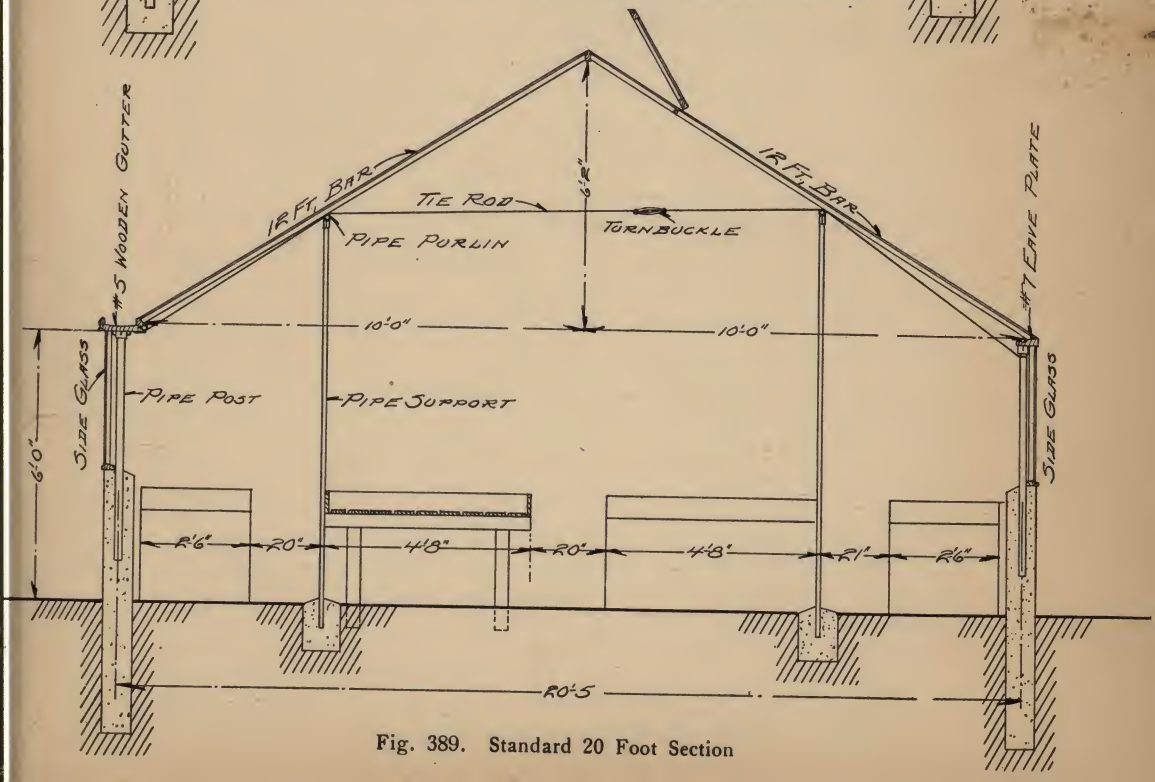


Fig. 389. Standard 20 Foot Section

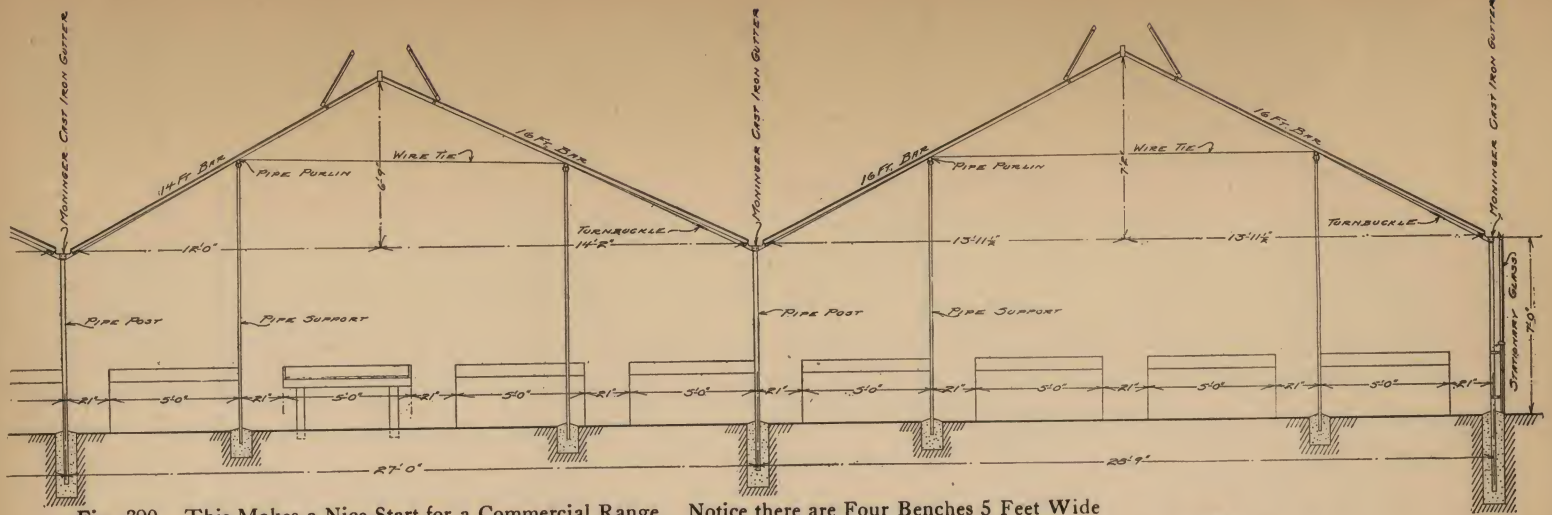


Fig. 390. This Makes a Nice Start for a Commercial Range. Notice there are Four Benches 5 Feet Wide in Each House. The First House must be 28 Feet, 9 Inches Wide to get the Bench Arrangement. This House is Shown on the Right of this Drawing. The 14 Foot Bars face the South

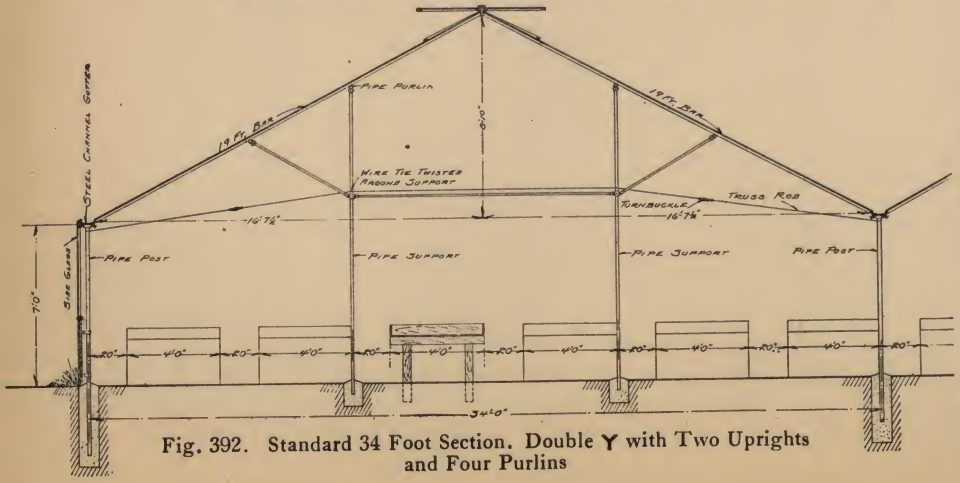
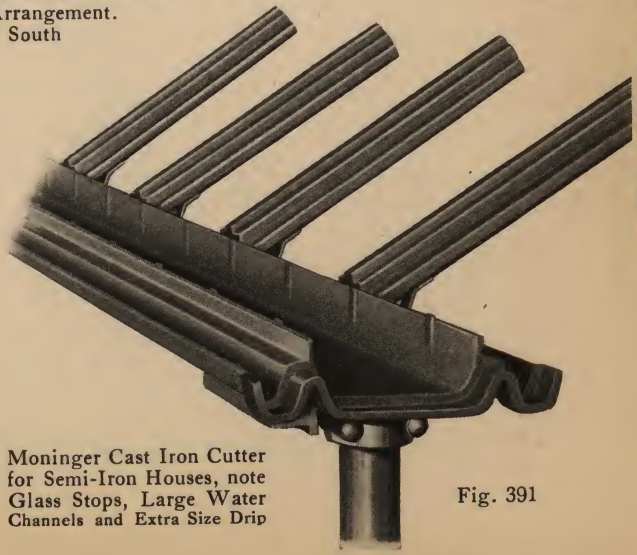


Fig. 392. Standard 34 Foot Section. Double Y with Two Uprights and Four Purlins



Moninger Cast Iron Cutter for Semi-Iron Houses, note Glass Stops, Large Water Channels and Extra Size Drip

Fig. 391

Combination Iron Frame and Truss Houses

Standard Types

The iron frame and the truss combined make a strong, rigid structure. A house as light as day and as solid as a rock. This is the construction that is rapidly coming into favor and we strongly recommend it as the ideal thing for commerical greenhouse plants.

Do not confuse this style with other makes of trussed houses—it is different. In the early styles no iron rafters were used and the trusses were fastened right to the wooden roof sash bars. In this way the wooden bar formed a part of the truss and really carried most of the weight. These houses are now known as "Trussed Sash Bar Houses." They have never been a success and a number of them have collapsed entirely under wind and snow pressure. No greenhouse is safe in the construction of which a wooden sash bar is made a compression member, or in which the wooden sash bar acts as one of the principal supporting members. We have never made a sash bar truss—it's N. G.

In our iron frame and truss houses the entire truss frame is made of wrought steel. The weakest member of the truss has a tensile strength of 60,000 lbs. per square inch, so you see it is a house designed for long and continuous service. The iron rafters are made of steel angles and these are placed 8 feet 4⅛ inches apart. At the ridge a wrought steel plate connects the two rafters (Fig. 393) and holds them securely in place. The upper rods are bent and carried through the ridge plate and the rafters, binding it all together. In this style of house the wooden members are used only for carrying the glass and of course are made very light. This eliminates shade to a very large extent.

You will notice the sash bars stop at the header line below the sash (Fig. 393) leaving space under the sash free and open. A purlin is carried the entire length of the house at this point and gives strength just where it is needed. The solid steel strut plate and the angle iron strut (Fig. 395) connect the upper and lower truss rods forming a powerful brace for the angle rafter. This connection makes the structure rigid and strong. The lower truss rod is bent at both ends same as the upper rod. The upper end passes through the strut plate and is held in place by a nut. The lower end passes through the angle rafter and is also held secure by a nut. The angle rafter is bolted to a wrought steel post collar (Fig. 394). This collar is held in place by a bolt that passes through the post. It is small and neat, yet strong and lasting.

You will notice the upper and lower rods are bent at each end and pass entirely through the part to which they are connected. This work is all done in our factory and trusses are shipped to you completely assembled. They reach you accurately fitted and when house is set up you will have a roof that is in line perfectly. No adjusting to be done. No chance to make a mistake. Just set in place and tie them together.

Iron Frame and Truss Houses—Standard Types

Fig. 393

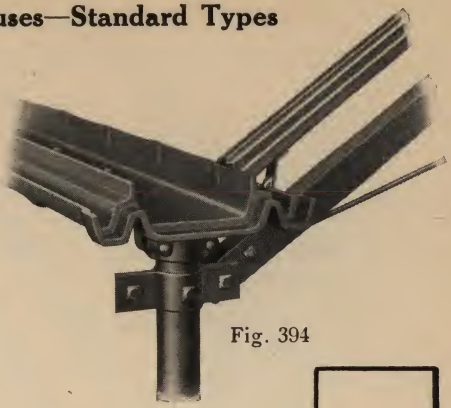


Fig. 394

Fig. 395

Fig. 396

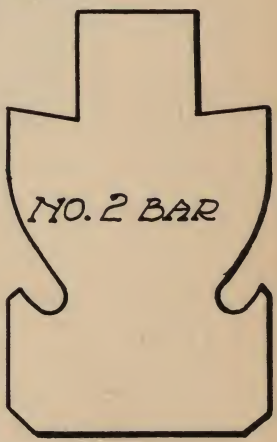


Fig. 397

Fig. 398

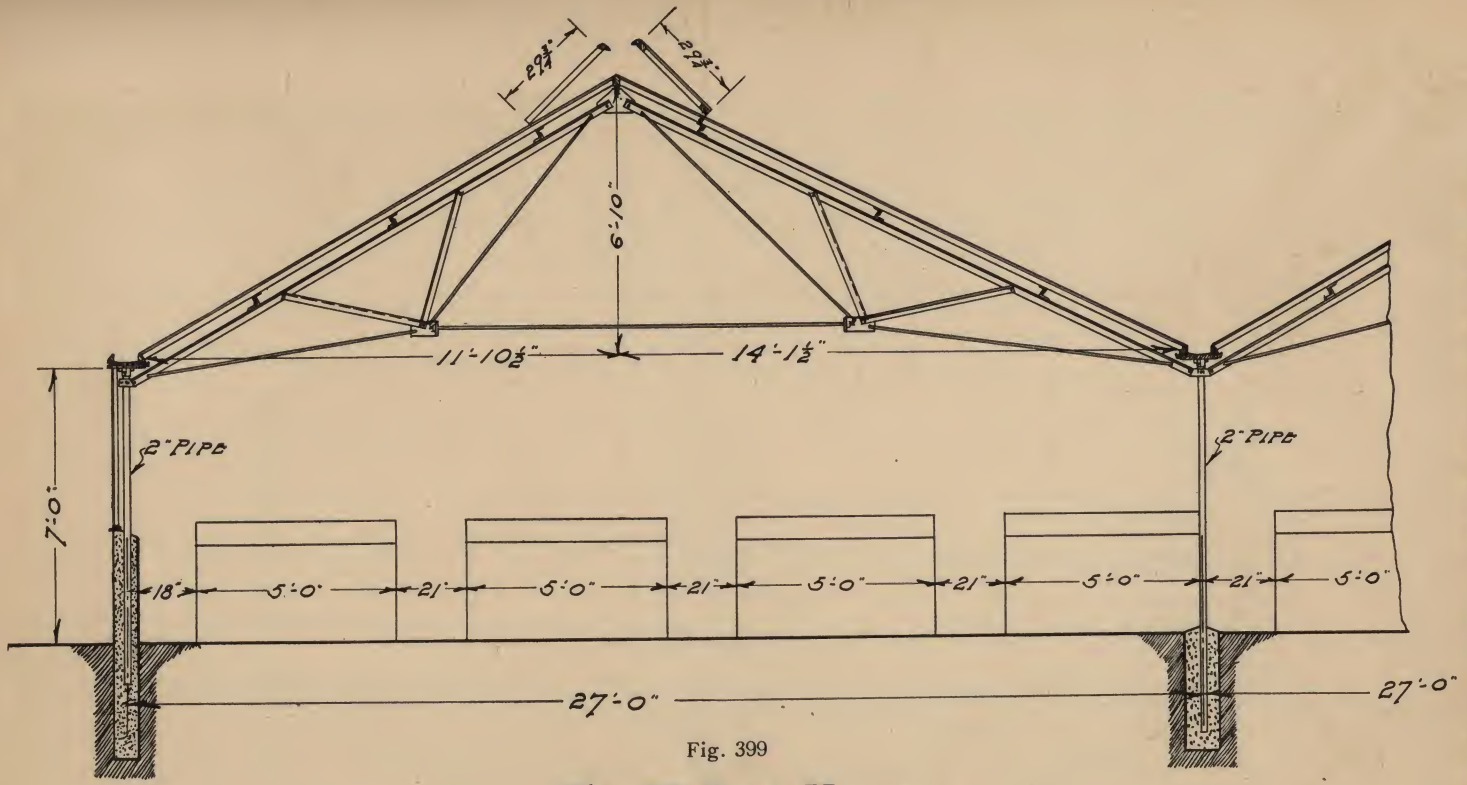


Fig. 399

The 27 Foot House

This is the famous 27 foot house used so largely for connected ranges in commercial plants throughout the country. In our opinion this house offers more and greater advantages than any other size. The bench arrangement is ideal. The uneven span roof saves on material and gives better reflection of the light. It is not too wide and one house throws but little shade on another. It is a strong, rigid house and easy to build. There are 4 benches 5 feet wide and 4 walks as shown above.

This type also made in standards widths of 21 feet, 25 feet and 28 feet 9 inches. Special widths also made at small additional cost over standard widths.

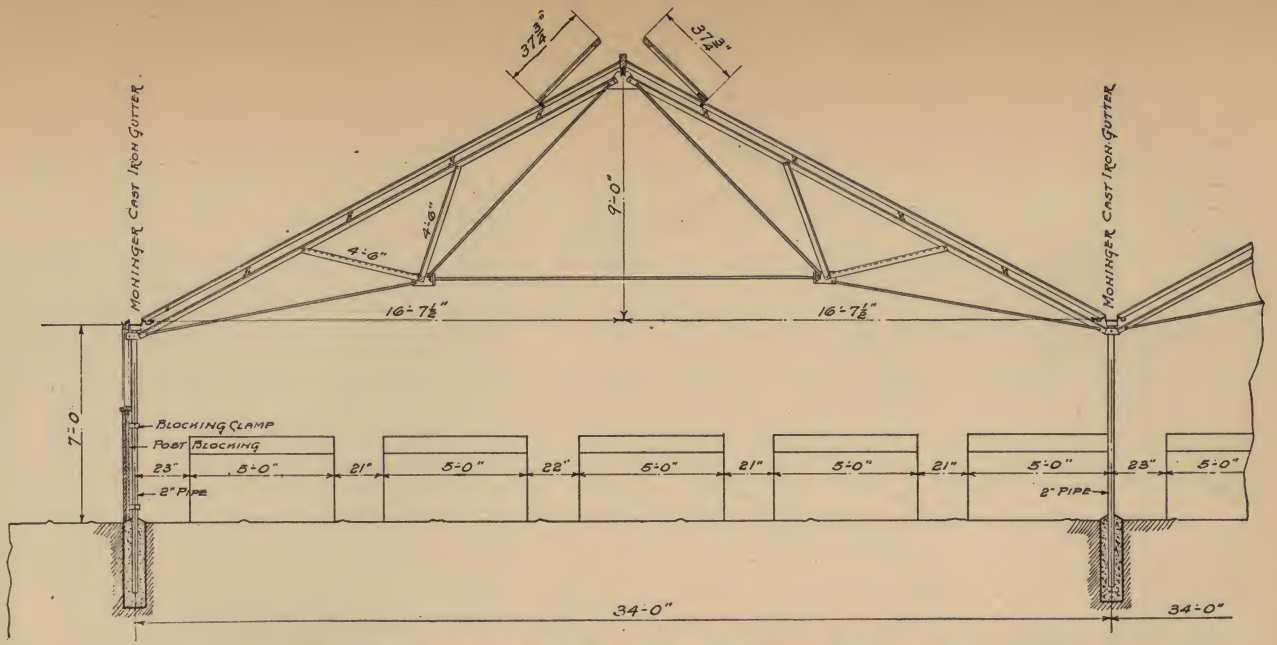


Fig. 400. Standard 34 ft. House Built Connected or Detached.

The 34 Foot House

Wide houses possess advantages not found in the narrower widths. The volume of air is larger and temperature and heating can be better regulated. For certain classes of stock, roses or chrysanthemums, and plants requiring extra head room, the 34 foot house is good. For houses running north and south it is a very good size and makes an economical range. In this width there are five benches five feet wide with five walks as shown. This makes 25 feet of growing space across the house to 34 feet of house width, compared to 20 feet of growing space in the 27 foot wide house..

This type also made in standard widths of 21 feet, 25 feet and 28 feet 9 inches.

Special widths also made at small additional cost over standard widths.

Iron Frame, Flat Rafter Houses

Standard Types

This is the house you have heard so much about. It is the highest type of construction on the market today and is the ideal thing for an up to date commercial plant.

The flat rafter construction is particularly suited for detached houses but can be used for connected ranges.

There are various ways of using the flat rafter. It all depends on the width and style of the house to be built. You want to be sure your house is properly designed before you order the materials for it. You want to be sure that all parts of the structure are good and strong.

In an effort to build houses as light as a bell glass a manufacturer is very liable to cut down the size of the various members until the structure is too weak. Competition also has much to do with this. You don't want the lowest price iron frame house—the chances are too many corners have been cut. First, last and all the time be sure the house is strong, rigid and safe. Not too heavy and not too light—it must be just right.

When you put your money in the best greenhouse to be had it is your duty to go into all the details and satisfy yourself of each and every pattern used. Take no chances of any kind and get a full 100 cents in value for every dollar.

If you will go into all of these things—if you will try to get hold of all the facts about the matter, you will want a Moninger House. If you only knew as much about our iron frame house as we know about it and if you knew all about the other makes you would place your order at once with us.

The Bassett & Washburn Co., Chicago, wanted to build the most modern range of glass in America. Messrs. C. L. and E. B. Washburn asked for plans, specifications and prices from every manufacturer of iron frame houses. They visited ranges that had been built by the various firms. They asked questions of every owner—they peeked into the corners and the out of the way places. Prices were carefully compared and every part of the construction was gone over down to the size and kind of screws used. After visiting the factories of the manufacturers and making the widest kind of an investigation they concluded there was nothing to it but Moninger made houses.

Now why did these people buy Moninger greenhouses? They had owned the second largest range of glass in the world for a long time—over 25 years. They knew the business as it is known by but few greenhouse owners. They knew that price was not the controlling factor. They knew that big talk and big advertising claims would not build good greenhouses.

They knew that the best greenhouse was none too good. They knew the best greenhouse was our iron frame, and they bought it. They would have no other. Their eyes were opened to some of the things that the ordinary greenhouse buyer would seldom see. They are right here in our home town—and they know.

We will furnish you the same houses at the same price and any house we make on the same price basis. They built five houses 34x600—probably the largest order for flat rafter houses ever taken by any firm. You will be treated to the same square deal we gave them—you will like our way of doing business and you will get your money's worth.

We were not the highest in price on the Bassett & Washburn job and we were not the lowest. Just a fair honest price for fair honest goods.

Get our estimate. If you have a proposition from us think this all over carefully before you spend the money. This is not bunk—it is the unvarnished truth, for we can honestly say the Moninger Iron Frame House is the best at any price.

Every part perfect. Every house a model by itself. Safe—Durable—Modern—Right.

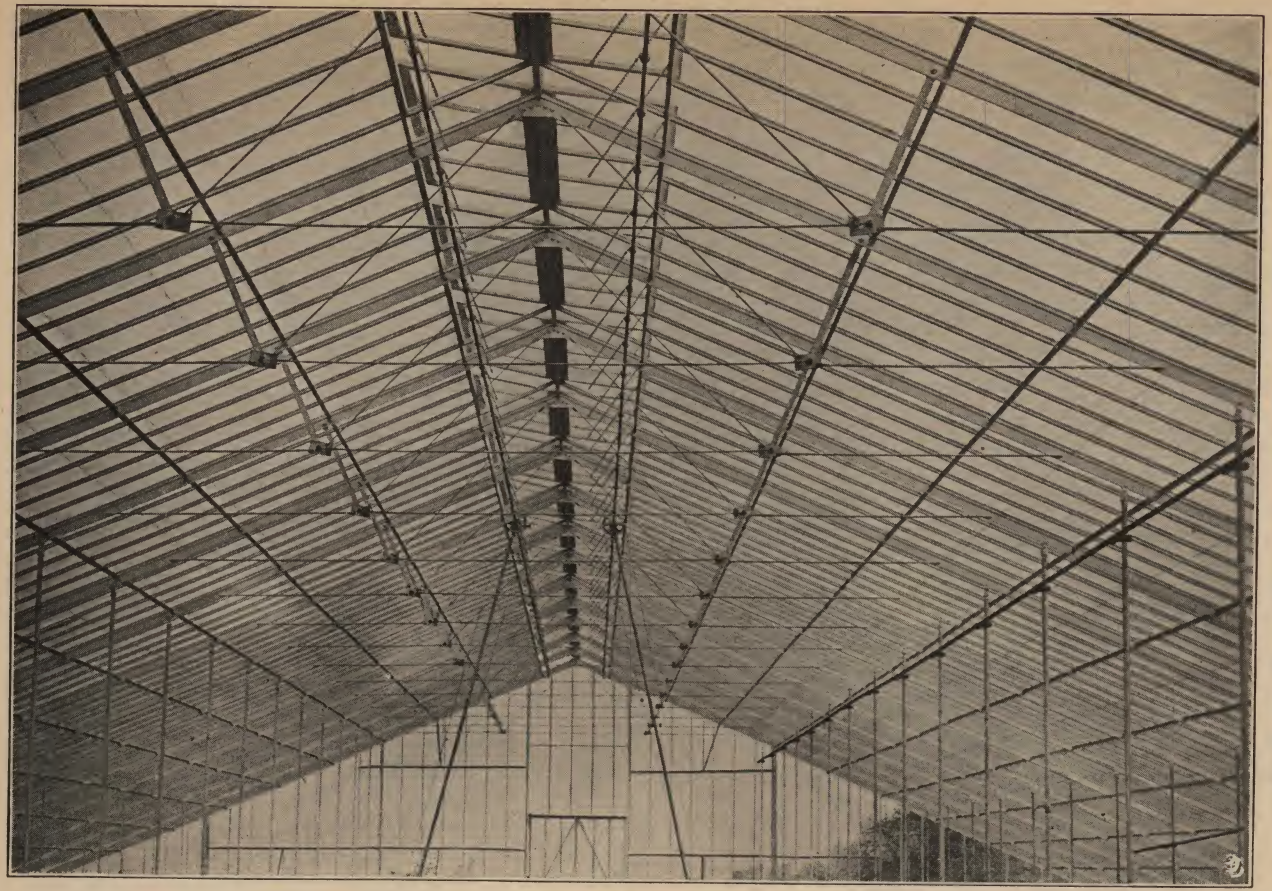


Fig. 401

House 123 feet wide built for Weinschenk & George, New Castle, Pa.—Heated with Moninger Steam Boilers.

Look at this Picture

It speaks all languages and it shows again that you can get anything in the greenhouse line from us and at the right price. We can furnish that new house, no matter where you live, and erect it too, if you want it that way.

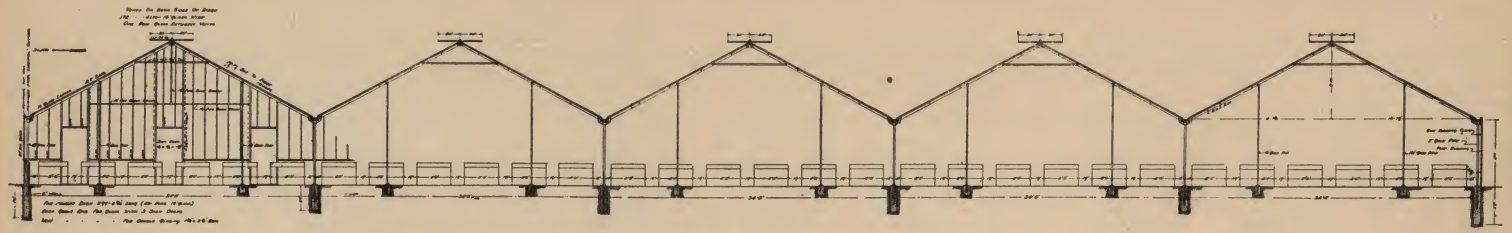


Fig. 402. Five Houses 34x600 for Basset and Washburn, Chicago, Ill.
The Best Houses Money Can Buy.

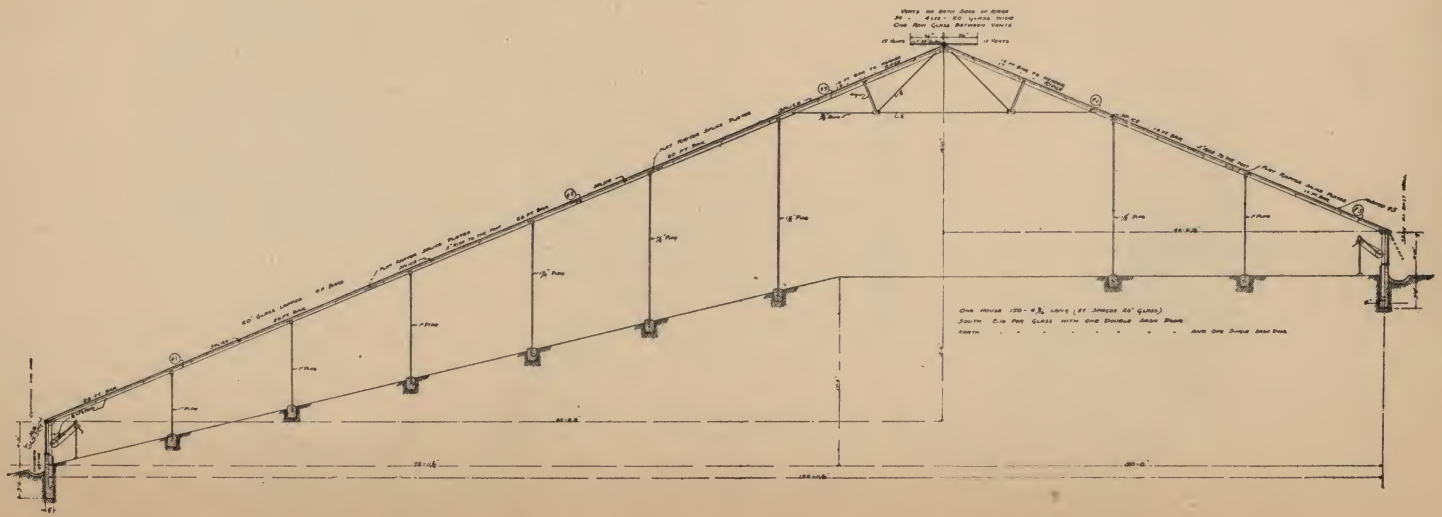


Fig. 403. Cross Section of Weinschenk and George House, 123 Feet Wide.

Iron Frame Flat Rafter Houses—Standard Types

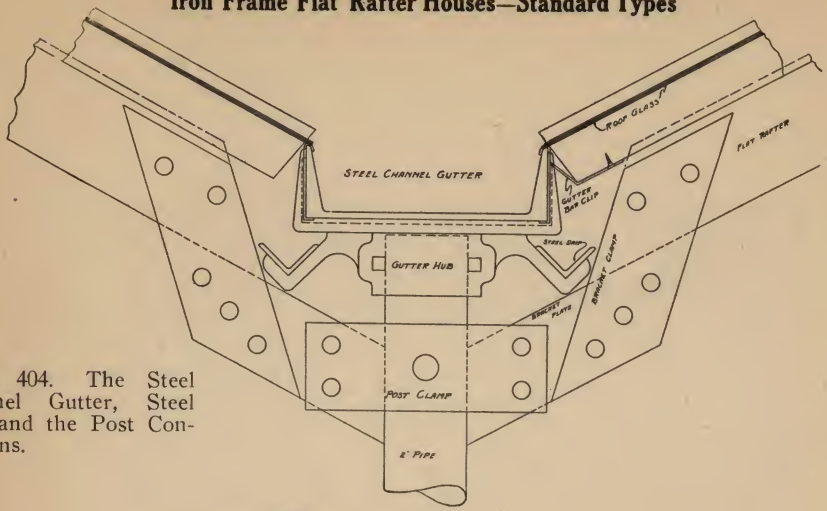


Fig. 404. The Steel Channel Gutter, Steel Drip and the Post Connections.

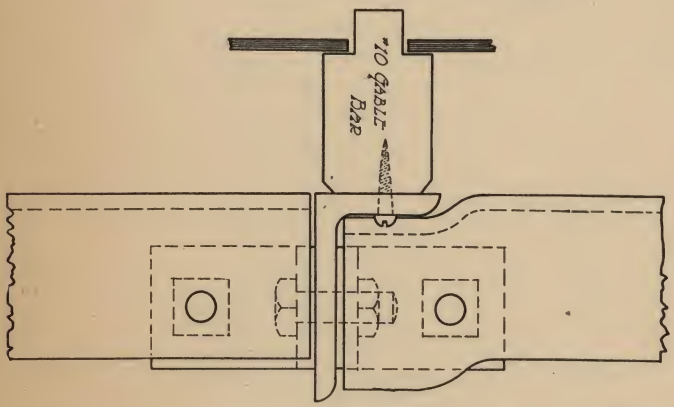


Fig. 405. Ends are always braced and by our method the house is made perfectly rigid.

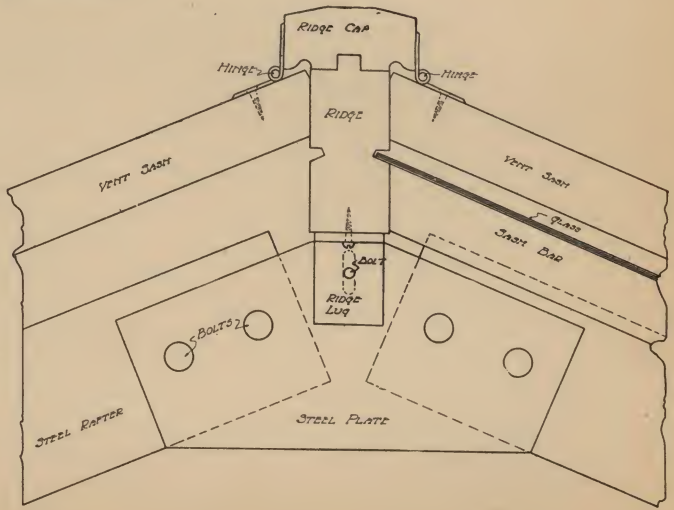


Fig. 406. Solid Steel Plates on each side of the iron rafter. Makes a strong house that will carry wind and snow loads perfectly.

Iron Frame Flat Rafter Houses—Standard Tpyes

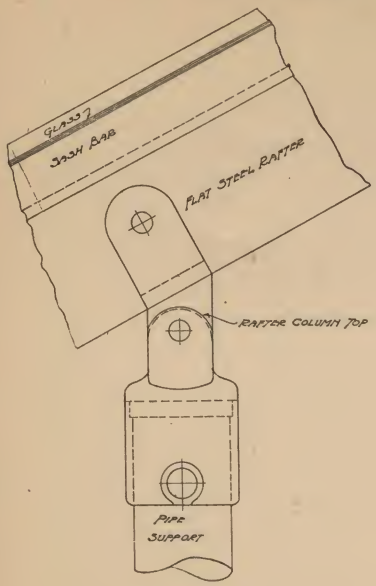


Fig. 407.

Method of Connecting Upright Support to Flat Rafter.

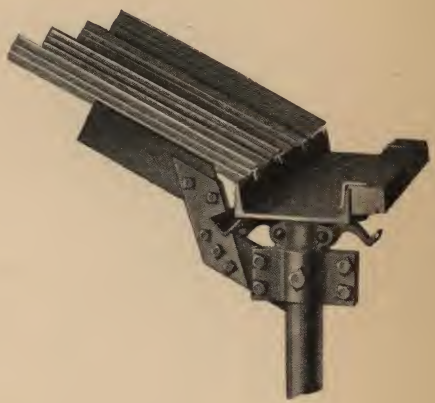


Fig. 408.

Channel Iron Gutter with Bars Attached. This Cut Shows Post Connections, Drip Gutter and Top Rail.

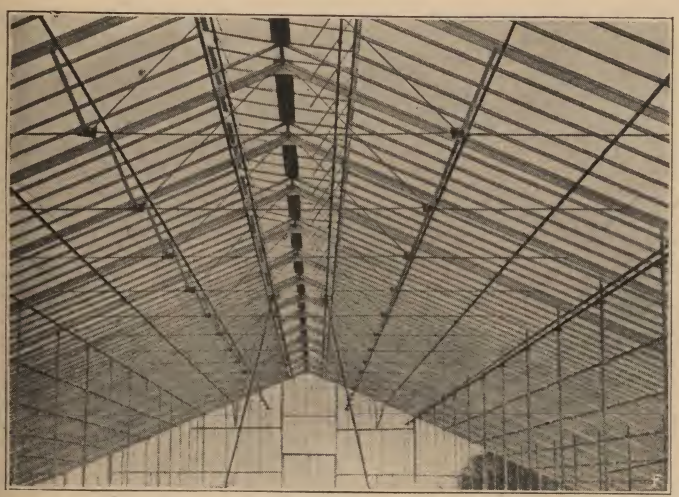


Fig. 409.

Interior of a House 123 Feet Wide Built Complete for Weinschenk and George, New Castle, Pa. Note how the Center Span is Trussed.

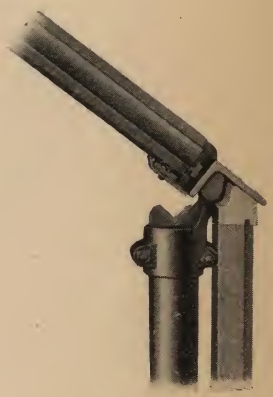


Fig. 410.

The Angle Iron Eave Plate and Post Connection. The Ideal eave for detached houses. It is always free of ice and casts but little shade.

Iron Frame Flat Rafter Houses—Standard Types

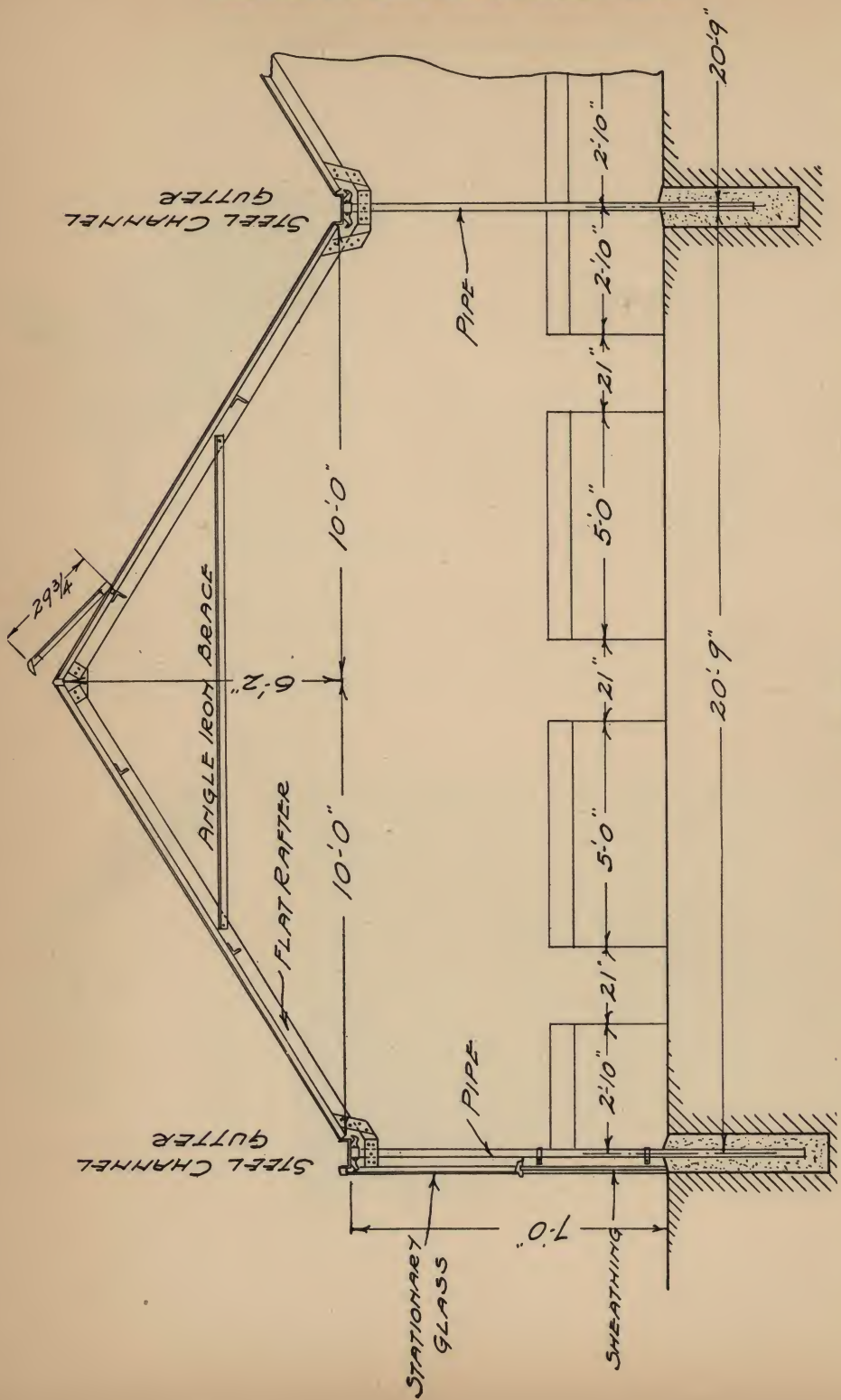


Fig. 411.
Standard 21 Foot House—No Inside Supports.

Iron Frame Flat Rafter Houses—Standard Types

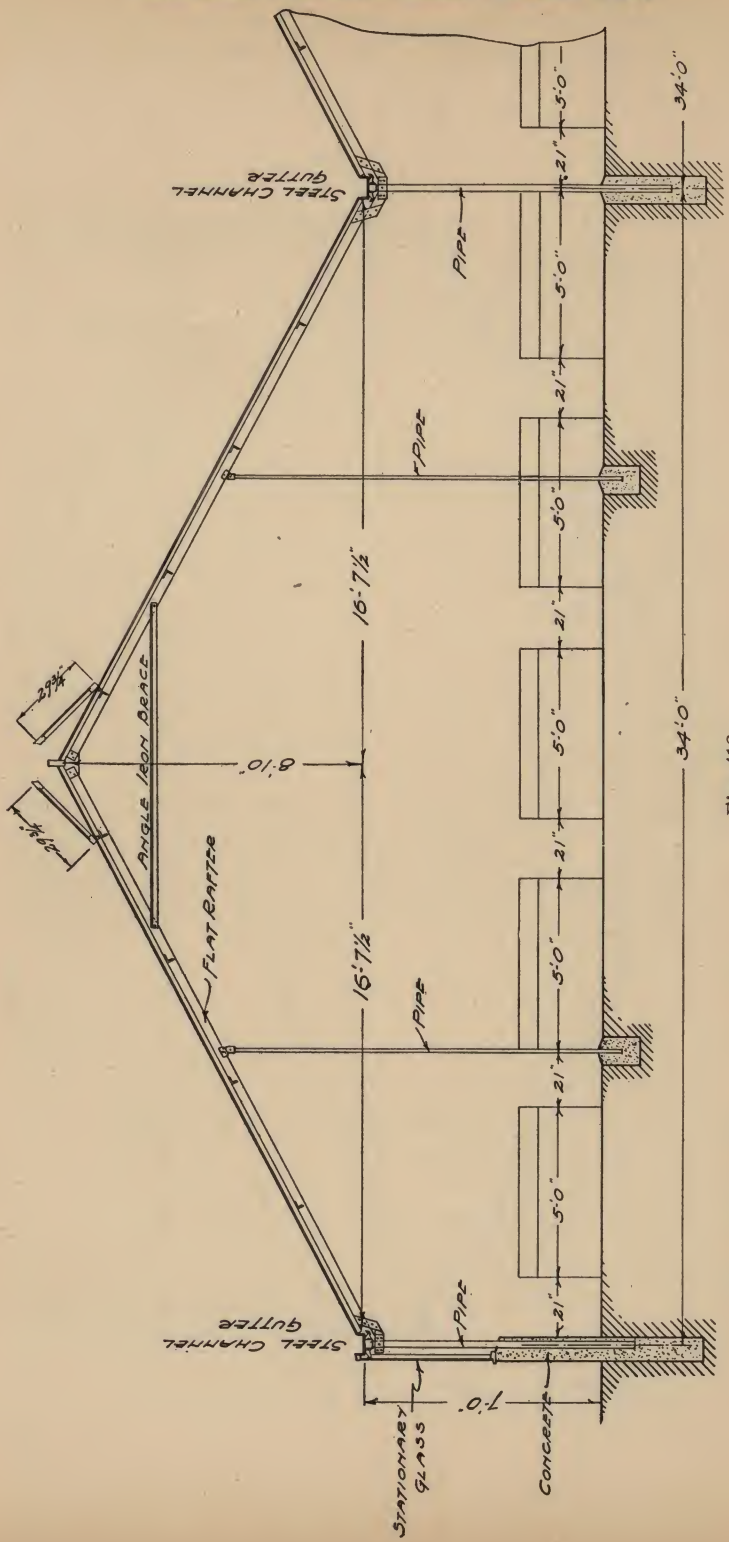


Fig. 412.

Standard 34 Foot Section. Benches can be made 4 feet wide, using benches in place of five as shown.

Iron Frame Flat Rafter Houses—Standard Types

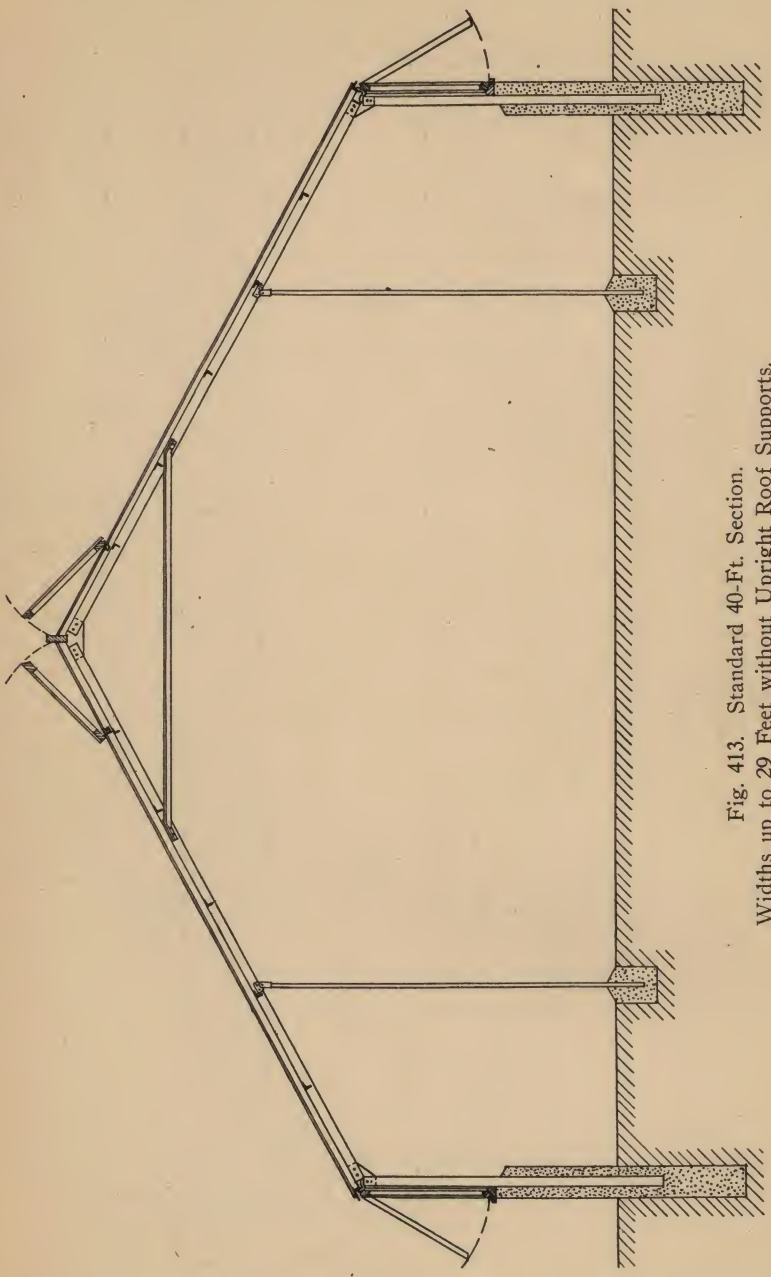


Fig. 413. Standard 40-Ft. Section.
Widths up to 29 Feet without Upright Roof Supports.

Iron Frame Flat Rafter Houses—Standard Tpyes

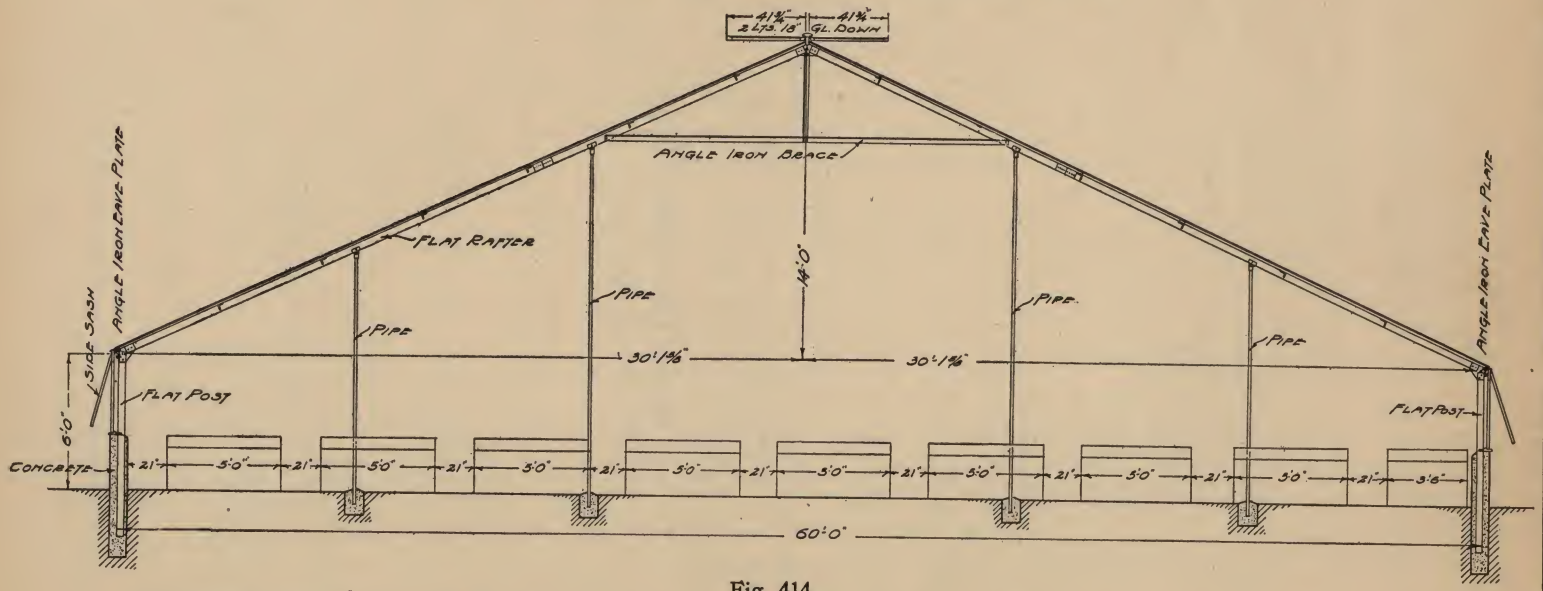


Fig. 414.

Standard 60 Foot Section with Two Lines of Upright Supports on Each Side. Angle Iron Eaves. Five Foot Benches.

Cost of Greenhouses

A house 10′ wide by 20′ long, including heating outfit and all construction material, will cost you, erected ready to grow in, approximately $265.00, based on the following specifications:

Side walls 6 feet; pipe posts; 3′ stationary side glass and 3′ sheathing below the glass in each wall; 16x18″ D. S. A. glass; Pecky Cypress benches, style No. 2; wooden gutters; ventilators on one side of the ridge; hot water heating; cast iron boilers.

For each additional foot of house in length, add $9.00.

The same house 14x20′ would cost approximately $300.00 and $9.50 extra for each additional foot.

The same house 16x20′ would cost approximately $325.00 and $10.00 extra for each additional foot.

The same house 21x20′ would cost approximately $350.00 and $12.00 extra for each additional foot.

The same house 25x100′ would cost approximately $1,500.00 and $14.00 per foot more or less.

The same house 28′ 9″x100′ would cost approximately $1,600.00 and $14.75 per foot for each foot more or less.

The same house 34x100′ would cost approximately $1850.00 and $17.00 for each foot more or less.

The same house 42x100′ would cost approximately $2,100.00 and $19.00 for each foot more or less.

The same house 49x100′, except wooden eave plates, instead of gutter, and double roof vents instead of single, would cost approximately $2,350.00 and $21.50 for each foot more or less.

The same house 56x100′, except wooden eave plates instead of gutter, and double roof vents instead of single, $2,600.00 and $23.50 for each foot more or less.

Connected Houses

Each connected house costs about 20 per cent less than the first house.

Iron Frame and Truss Houses

This type of construction costs about 70c per lineal foot of house more than the semi-iron type mentioned in the above figures for houses up to 28′ 9″ wide and $1.30 per lineal foot more for houses up to 34′.

Iron Frame Flat Rafter Houses

This type of construction costs about $2.00 per lineal foot of houses more than the semi-iron type for houses up to 25′ wide, about $2.25 per lineal foot more for houses 26′ to 42′ and about $2.50 per lineal foot more for houses over 42′ wide.

Concrete Walls

If concrete walls are preferable to wood walls, their cost will be about 25c per square foot of wall above the grade, and 35c per square foot below the grade more than the wood wall and pipe post house.

Steel and Cast Iron Gutters

Cast iron gutters cost about 30c per lineal foot of gutter more than the wood gutter. Steel channel gutters cost about 15c per lineal foot of gutter more than the wood gutter.

Steel Eave Plates

Steel angle eave plates cost about 15c per lineal foot of plate more than the wood eave plates, and 15c per lineal foot less than the steel channel gutters.

The Service Building

The above figures do not include any service building, boiler pit, chimney, or workroom. This part of the greenhouse plant can be built according to the wishes of owner and your local contractor. We can readily give you the approximate cost of the materials based on your home market prices.

About Price Basis

These calculations are based on certain market prices of various commodities in effect August 1, 1913. Any change in these prices will, of course, affect the figures. It is impossible to give printed price lists on parts that will be of any benefit to the customers, as considerable experience is required to enable one to estimate accurately on the requirements for a complete greenhouse. For this reason we issue no price list on structural material, but will cheerfully quote on separate items for repairs at any time.

Standard Sizes of Greenhouses

Based on benches five feet wide and walks 20 inches wide, the following is a list of standard widths of greenhouses adopted by us. Material for standard widths will cost you a little less than for special widths. It should be borne in mind that these widths will vary a few inches depending on whether gutter or eave plate is used and on the size of the gutter or plate used. Measurements are center to center of posts.

No. 1	14 ft. 9 in.	To be built in range form. Arrangement modified for detached house.
No. 2	21 ft. 0 in.	
No. 3	25 ft. 0 in.	
No. 4	27 ft. 0 in.	Range form only.
No. 5	28 ft. 4 in.	Detached form only, or for first house in a range.
No. 6	28 ft. 0 in.	
No. 7	34 ft. 0 in.	Range form only.
No. 8	41 ft. 8 in.	Detached form only.
No. 9	48 ft. 8 in.	Detached form only.
No. 10	55 ft. 8 in.	Detached form only.
No. 11	62 ft. 0 in.	Detached form only.
No. 12	68 ft. 8 in.	Detached form only.

Information required for making Estimates on Greenhouse Construction Material

Sketches and Estimates furnished Free of Charge

(Do not cut this page—send for Blanks)

1. Number of houses?
2. Detached or connected?
3. Will length of houses run east and west?
4. Width of each house center to center of posts?
5. Length of each house outside?
6. What size glass will you use?
7. Which ends are wanted glazed?
8. Where are doors wanted?
9. Are gutters or eave plates wanted for walls?
10. How high are walls to be from ground to eaves?
11. Will you use concrete, brick, stone or lumber for walls?
12. Do you want stationary glass in walls below eaves? If so, how much?
13. Do you want hinged sash in walls below eaves for ventilation?
14. On which wall do you want glass or sash?
15. Do you want to hinge roof ventilator sash to ridge or header?
16. Will you have solid beds or raised benches?
17. What kind of stock are you going to grow?
18. Do you want the material cut and fitted ready to set in place?
19. Is the land level or has it a slope across the width of the house? If slope, how much?
20. Do you want semi-iron construction?
21. Do you want iron frame flat rafter construction?
22. Do you want iron frame truss construction?

Show your idea by making a sketch and refer to our catalogue for information. You will find various styles of houses illustrated and described and also details of the patterns used in construction of the houses.

Construction Details—Standard Patterns

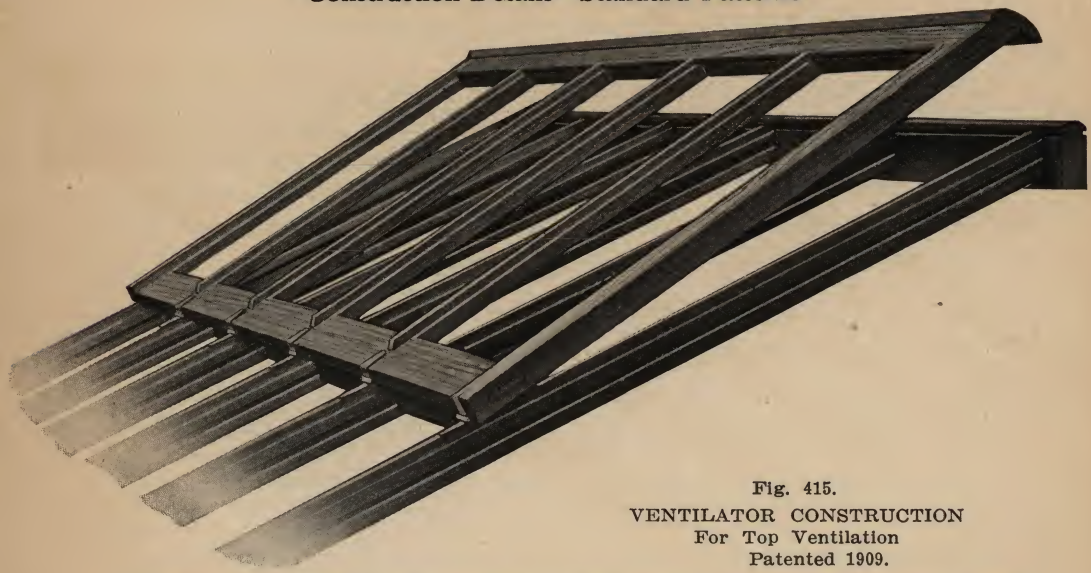


Fig. 415.
VENTILATOR CONSTRUCTION
For Top Ventilation
Patented 1909.

The details here show top ventilation with our patented construction. The sash you will notice are hinged directly to the roof bars by special hinges and a small header is used placed beneath the bottom rail of the sash. The hinges are our famous bar hinges about which you have heard and read so much during the last two years. This is probably the greatest improvement made in ventilator construction since greenhouses were first put up and if there ever was any doubt as to the best method of ventilation the balance is surely now in favor of sash opening at the top.

The use of a hinge at every bar on the roof fastens the sash securely, spaces the bars equal distance apart and prevents the sash from warping or twisting out of shape. With the old style, hinges were fastened to headers nailed between the bars and sash finally came loose. The wind will be less liable to take the ventilators off the roof with these hinges or the sun to warp the sash. Aside from this, the hinges in connection with the new header do away with the large shade line, eliminate drip from condensation, prevent ice forming beneath the bottom rail and cause the sash to operate more easily. Really, there is so much gained with these hinges there is no comparison between them and the old style. When the sash is open the condensation forming beneath the glass is carried down to the bottom rail and directly out on the upper side of the roof glass. The warm air inside coming in contact with the glass at the point where hinges are placed melts ice as fast as it forms and sash can always be closed down tight. The header being beneath the bottom rail casts no shade as it is in direct line with the bottom rail itself.

There are two styles of hinges; one to fit the rail of the sash and the other to fit the stiles or ends. The two styles are shown here in detail also a section of the roof and a detail of the header. No other manufacturer can supply this construction as it is fully covered by letters patent and all infringements, either buying or selling, will be prosecuted.

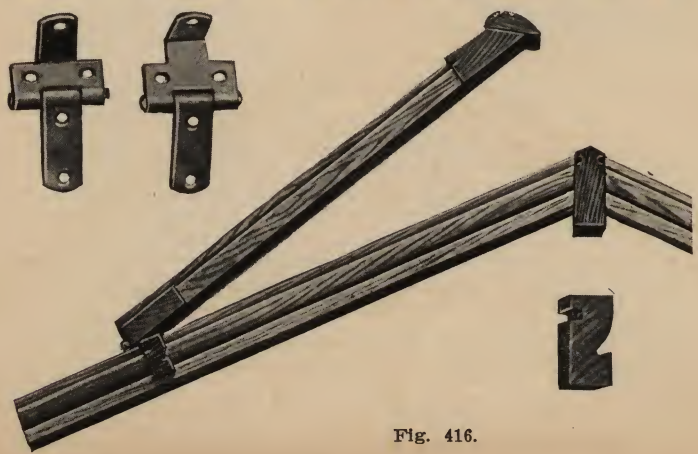


Fig. 416.

Construction Details—Standard Patterns

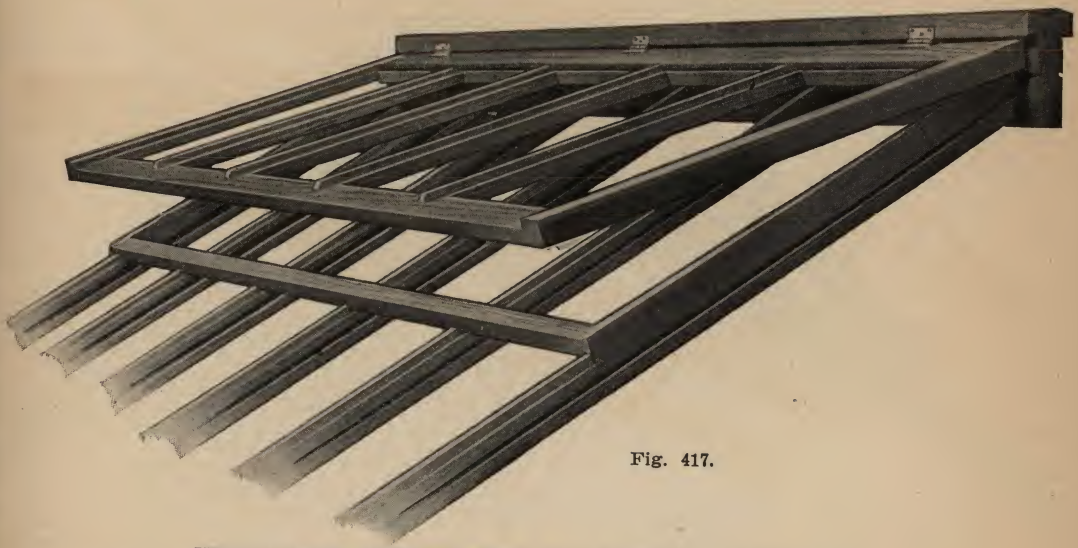


Fig. 417.

VENTILATOR CONSTRUCTION FOR BOTTOM VENTILATION

Many people prefer bottom ventilation for their houses and we show here our method of handling this feature of construction. You will notice the sash does not lie flush with the roof but is raised about an inch above the bars and rests on a frame-like construction. The lower piece on which bottom rail of sash rests is called the seat strip and the side pieces weather strips. The seat strip is notched to fit over the roof sash bars and the weather strips are made wedge shaped and rabbeted to close up the opening at the sides. This makes a good tight job and is much better than the old style with large clumsy header nailed between the bars.

The sash fits close under ridge cap and you have a good water tight connection at the ridge. This is really important for there will be considerable drip at this point unless a cap is used and of course drip is to be avoided as far as possible. The detail below shows seat strip notched, the sash bars as they fit into it, and a detail of the weather strip. Notice the construction of the ridge in the detail. The cap has a groove through the center which fits over a tongue on the ridge piece and on each side of the cap there are small drip grooves so that any water coming down from the top of the cap is cut off and drops to the roof.

One thing here we want you to remember, the lower end of the bars on all our ventilators are beveled so they shed water perfectly. This is a little point but it is important and illustrates the care used by us in getting out material.

Another thing, our ventilators are all sand papered before being shipped. Some manufacturers overlook these details but they are worth money to you.

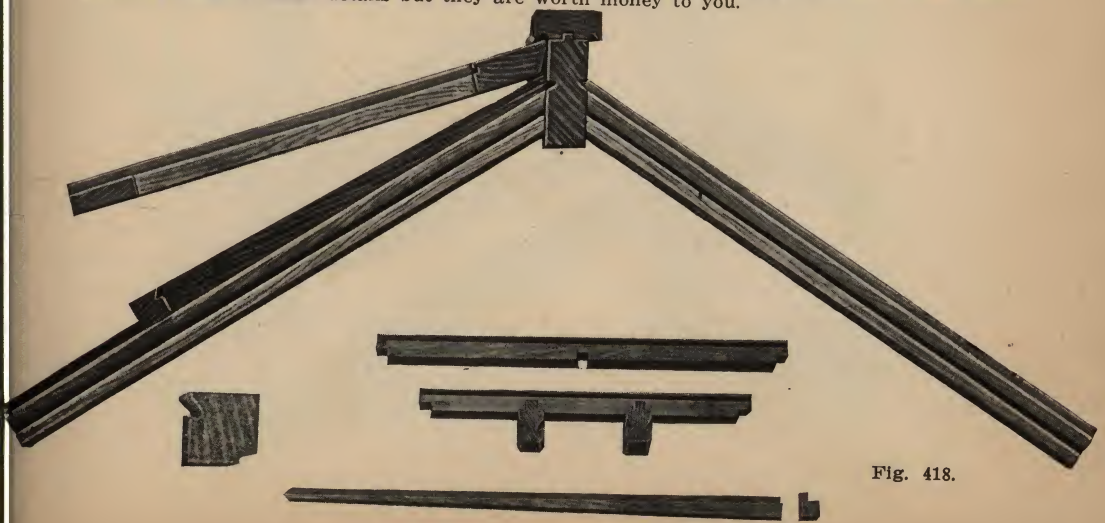


Fig. 418.

Construction Details—Standard Patterns

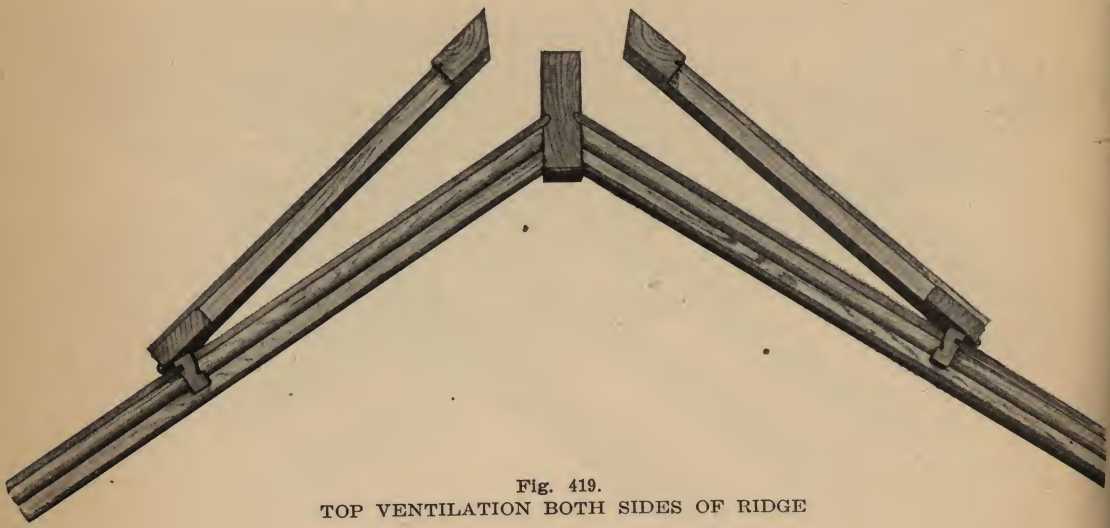


Fig. 419.
TOP VENTILATION BOTH SIDES OF RIDGE

Where a large amount of ventilation is desired, sash are often placed opposite each other on both sides of the roof and where they open on the top it is necessary to use the construction shown above or something similar to it. The sash you will notice are beveled so when closed they fit tight against the ridge. Our famous sash bar hinges can be used for any kind of top ventilation and we show them here together with our shadeless header.

Where sash are placed alternately on the roof and are not opposite each other the top ventilation described on previous page, with cap to fit over the ridge can be used. The objection made to the construction shown above is that it is not water tight at the ridge. There is hardly any way to get around this in a satisfactory manner, but our sash are perfectly made and the amount of drip is reduced to the minimum.

The detail below shows bottom ventilation with a small ridge. This is not to be compared with the arrangement shown on previous page, for our improved cap does away with the drip at the ridge. The seat and weather strip arrangement is just the same for these sash, however, and the only difference is the method of hinging. This construction is cheaper and that is the one advantage it has. The hinges used are the same as the ones shown on previous page. These hinges have brass pins and are heavily galvanized.

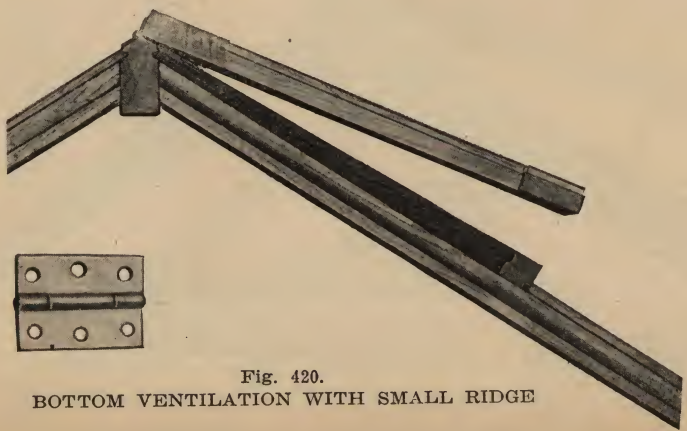


Fig. 420.
BOTTOM VENTILATION WITH SMALL RIDGE

Construction Details—Standard Patterns

The Moninger Double "Y" Arch.

The greenhouse that admits the most light is without doubt the best one to use provided the construction is made strong enough to withstand wind and snow pressure. With this idea in mind makers of material are constantly trying to produce a house that will cast the minimum amount of shade. This connected with the tendency in recent years to build wide houses has brought out a large number of improvements in greenhouse construction such as the several forms of trussed houses and combination iron frame and trussed houses.

Improvements in fittings for supporting members and in the making of castings has had a great deal to do with the changes in greenhouse types as far as supporting is concerned. The split tee and "Y" brace are two fittings that have acomplished more than any other two we know of and these two fittings have been combined in our double "Y" arch construction shown on this page.

Formerly it was customary to use four lines of upright supports for houses requiring four lines of purlins (two lines for each slope of the roof), but as shown in the cut below, only two lines of upright supports are used in this construction. The upright supports are placed under the two upper purlins fitted with "Y" braces below and connected with pipe arms to the two lower purlins.

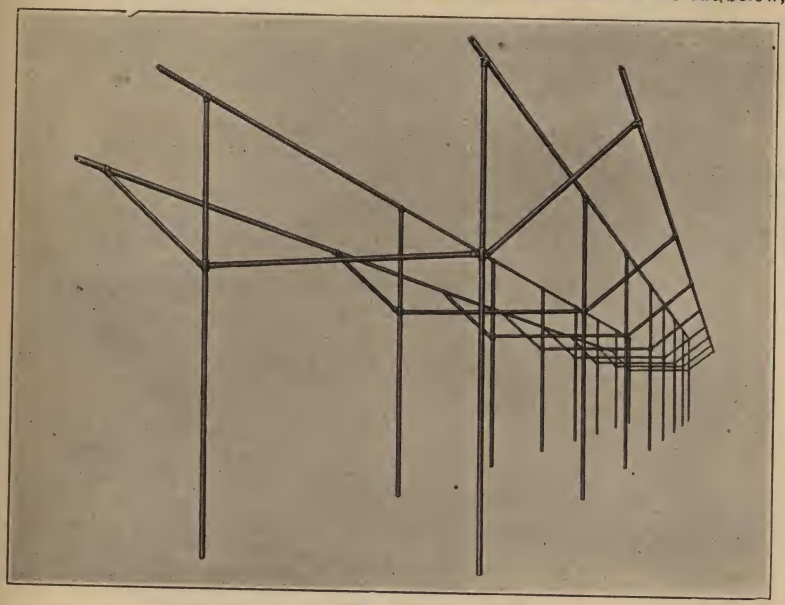


Fig. 421

To brace the uprights a pipe is carried across from one to the other forming an arch which perfectly sustains the weight of the roof at all points. Without doubt this double "Y" arch is the strongest combination of pipe frame and split fittings ever put on the market. You have practically all of the growing space free of obstruction and the minimum amount of shade.

This construction costs less money than four lines of upright supports, is easier to set up and makes a better appearance. It is a far better arrangement than two lines of upright supports for the lower purlins and a line of upright supports in the center under the ridge with the "Y" brace and arms for the upper purlins.

Fig. 422

Fig. 423

As an additional brace and tie we use a wire truss with this construction. This wire is carried from the eave line over lower purlins around upright supports and down to the eave line on the opposite side of the house. The wire is drawn tight with turnbuckles a cut of which we show here.

Fig. 424

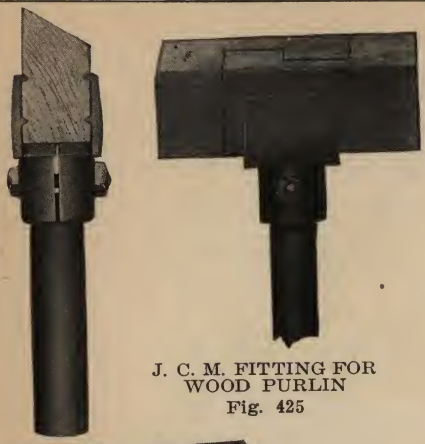
The cost of this wire is small, casts no shade and is a great help. Many a roof has been saved from wind by the simple wire truss.

Construction Details—Standard Patterns

Purlins and Purlin Supports

We show here three kinds of purlins and fittings; pipe, angle iron and wood. Our improved split fittings are used for each of these three forms and all of them are made to clamp on the purlin support with one bolt through the center. These fittings are very simple, easily adjusted and make a nice neat job.

The fittings for wood purlin, you will notice, have small teeth cast on each side which press into the wood when the two pieces are clamped to the purlin support. When this fitting is once clamped in position it cannot get away from the purlin. This fitting should always be placed on the purlin at the splice so it will hold the two pieces together and prevent joint from coming apart.



J. C. M. FITTING FOR WOOD PURLIN
Fig. 425

The split tees for pipe purlins are so well known they hardly need description. These fittings are not only used for pipe purlins but for pipe frame benches, for railings and for many other purposes. The pipe purlin is fastened to the roof bars with galvanized straps and galvanized screws. We can furnish various sizes of tees and straps and will send complete list on request.

SPLIT TEE FOR PIPE PURLINS
Fig. 426

The angle iron purlins, as shown below, are fastened to roof bars in two ways. One method is to drill holes in the angle iron the same distance apart as the bars on the roof are spaced, and the purlin then fastened with screws. Another method, and a better one in our opinion, is to fasten the purlin with small galvanized clips and screws. With these clips you are always sure to have your bars spaced equal distance apart and it is easier to fasten the purlin in place with these than it is with the holes drilled through the iron. One part of the clip can be fastened to the bars before they are put on the roof if you are very careful and measure and locate the exact position for the purlin. When the bars are up each end of a length of purlin can be fastened by adding the other half of the clip and the balance of the clips can then be put on. You will find these clips convenient when you come to glazing, for should bars at any point be too close a tap with the hammer will space them just right for the glass.

PURLIN PIPE STRAP
Fig. 427

ANGLE IRON PURLIN WITH CLIPS
Fig. 428

ANGLE IRON PURLIN WITH HOLES PUNCHED
Fig. 429

RIDGE FITTING
Fig. 430

Construction Details—Standard Patterns

Gutters and Eave Plates

Wood gutters have been used for such a long time that all patterns have been tested fully and there is really not a great deal to be said about them.

We have found there is only one way to make a good water tight wood gutter and this is the construction used for our No. 5 pattern shown here. The pieces you will notice all fit together on the tongue and groove principle. There is a groove on each side of the plate and a tongue on each sill to fit into this groove in the plate. The upper part of the sill extends over the edge of the plate and the groove and tongue hold the sill down in its place. The sash bars rest firmly and completely on the beveled edge of the sill making a neat and strong job. The entire end of the sash bar rests securely, not just half of the bar as is the case with a rounded sill. The drip gutters are set into the sill so when once nailed in position they are there to stay and are not easily split or broken off.

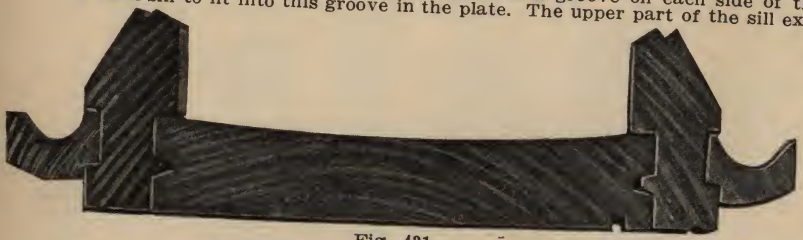


Fig. 431
NUMBER 5 GUTTER. "OUR BEST

It costs more money to make this gutter than it does the ordinary patterns, but the money is well spent and you will always be satisfied with it as it does not need constant repairing. With this style of gutter, too, you have the bottom entirely free underneath and there is room to fasten your wire truss without damaging the drip gutter.

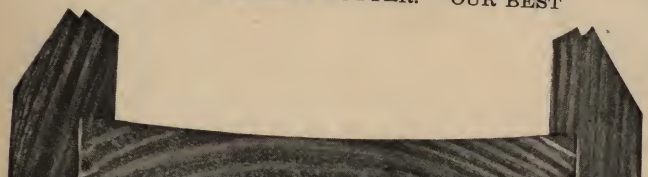


Fig. 432
NUMBER 9 GUTTER

The only way to put the wood gutter together is with thick white lead a very little thinner than it comes in the casks. You must use plenty of this lead on the pieces and nail them together to stay. If this is done with the No. 5 gutter we guarantee it to be water tight.

NUMBER 12V GUTTER
Fig. 433

A cheaper gutter is the No. 9 pattern which you will noticehas plain sills and bottom. This gutter is not as good as the No. 5 pattern and the only advantage it has is in the cost.

No. 2
Fig. 436

Our No. 12V gutter shown at left is made to meet a demand for a cheap gutter for houses of narrow widths. It is easier to walk in than the ordinary so-called "V" gutter and also carries more water. The perfect tongue and groove joint at the bottom edge prevents leakage.

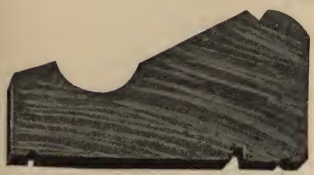


Fig 434
NUMBER 7 EAVE PLATE
"OUR BEST"

Our No. 7 eave plate is the one we have spoken so much about in other parts of the catalogue. It casts very little shade, is strong enough for the widest house, is made all in one piece with drip conductor and is ice clearing. There are practically no objections to this plate and if you have occasion to use anything but a gutter on your greenhouse, by all means put in this No. 7 pattern.

No. 1
Fig. 437
DRIP CONDUCTORS

NUMBER 8 EAVE PLATE
Fig. 435

Another plate, designed on the same lines as our No. 5 gutter, is the No. 8 pattern. This plate is a very good pattern to use where you have a solid concrete or board wall up to the eave line.

Wood gutters or plates will last as long as any other wooden part of the greenhouse. We prefer them for construction work as they are easier to handle, make a good job and are just as durable as anything you can get. On some of our houses we have wooden gutters and plates in use

Construction Details—Standard Patterns

Pipe Posts and Fittings for Walls

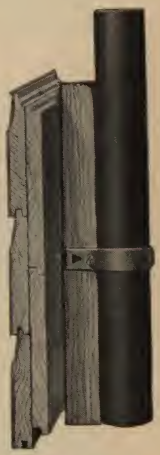
Without doubt pipe is used more generally for wall posts than anything else on the market not excepting the time honored wood posts which were used almost exclusively several years ago. Fittings of various kinds have been designed and used and improvements made from time to time until today the construction is almost perfect.

The fitting for the top of the post is the most important one. The hub shown here is designed with a very deep socket is split and is fastened to the post with bolts. The deep socket allows for adjustment up and down so if posts are not all set to exact height the inaccuracy can be taken care of.

SIDE WALL CONSTRUCTION
Fig. 438

The hub is made with slotted openings for the screws in place of round holes and you will find it much easier to fasten them to the gutter on this account. The hubs also have a round opening directly above the post which permits air to circulate and carries away any moisture that may get between the hub plate and the gutter bottom. For strength we have provided flange pieces on four sides and this distributes the load over the widest possible area.

The hub shown here is designed for gutters six inches wide and over but we make a special fitting for narrow gutters and for eave plates. This special fitting has shorter side lugs but otherwise is of the same general construction.



BLOCKING CLAMP
Fig. 440

For wood walls with pipe posts we advise the use of our famous blocking clamp shown here.

Only the best wrought steel is used for making these clamps and they are far superior to "U" bolts. With the old fashioned "U" bolts it was necessary to have the post blocking on one side of the pipe posts and the "U" bolt passed through this blocking and around the post. The blocking of course was a large piece as it extended from the sheathing to beyond the inside edge of the post. With this clamp only a small piece of blocking is used between the blocking and sheathing as shown and the construction is very neat, strong and light. We use "U" bolts now only when the form of construction necessitates it. The fittings are heavily galvanized by the hot process and will last as long as the posts.

POST TOP FITTING
Fig. 439

"U" BOLTS
Fig. 441

Construction Details—Standard Patterns

SASH BARS

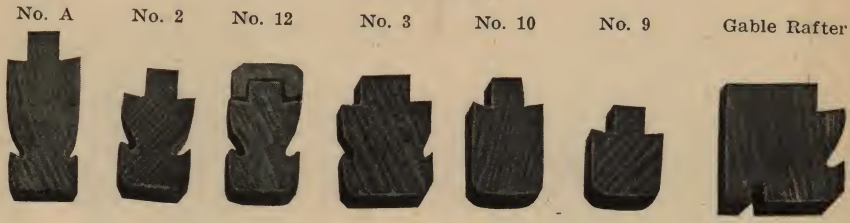


Fig. 442

Above are a row of our standard sash bars. They are not shown full size but you can get a good idea of their shapes. All you have to do is to tell us the width of the greenhouse you intend to build and we will furnish the proper size bars.

We can furnish all sizes of these sash bars up to and including twenty foot lengths. Any thing longer than this must be spliced and for this we have a very neat and strong cast iron shoe which fits around the lower part of the bar.

For curved roofs we first saw these sash bars out of a solid plank and then run them through the moulding machines. To steam bend or spring sash bars anywhere on a greenhouse is a big mistake as the moisture inside and unequal temperature always warps and twists them out of shape.

Sash bars are not so simple to make as one would suppose. They must come out of the machines perfectly smooth and accurately shaped. To accomplish this properly the knives of the machines must be kept sharp as a razor and perfectly balanced. All of the intricate parts must run smoothly and freely. We have designed our own style of machines with many little things all uniting to make perfect materials.

The bulk of the paint for the greenhouse is used on the sash bars and if these bars are rough or fuzzy a large part of this paint is going to be wasted to say nothing of the brushes used up. It takes longer to paint rough bars then it does smooth ones and the paint that you use is not distributed equally or evenly over the surface. Paint costs money and a small amount saved runs into dollars quickly.

SPLICES

Fig. 443

The splicing of material for a greenhouse is very important. The wood gutters, purlins, ridge, sills, etc., are made in lengths and these pieces must be joined together to make a run according to the length of your house.

Formerly one-half of the thickness of the pieces was cut on each end of each length and the two were then lapped over each other forming what we call a lap splice. The cut here shows our famous lock splice which is so far ahead of the lap splice there is practically no comparison between the two. You will notice the pieces are cut perfectly so that each locks into the other and when once set together there is no coming apart.

With the old lap splice when the lumber began to shrink, the joints came loose and the moisture soon caused decay. With the lock splice the entire run shrinks as one piece and joints remain always perfect.

Use good thick white lead on all splices and nail them tight so no moisture can ever get in and you will have a joint almost as perfect as the piece itself.

This lock splice is fully protected by us and you are cautioned against buying, selling or making it. We have a special machine for doing this work and the splice cannot be had from other manufacturers. This is just another small detail that shows how careful we are in making our goods.

Construction Details—Standard Patterns

GREENHOUSE SUNDRIES

For doors such as are used in the gable ends or walls of greenhouses we furnish mortise locks or latches, generally the latter as they are more convenient and durable. The locks easily get rusted and jamb but the latches are galvanized, made reversible and the handle is "off set" so that one will not strike his knuckles on the door jambs.

The door hinges are made of 3½x3½ steel and heavily galvanized by the hot process. A brass pin made so as to be easily removed is the pivot in the center. This is a very desirable feature as the doors may be removed and set aside when occasion demands. With the old style tight pin hinges the doors, when open, swing back and forth in the wind and are liable to break glass and damage the gable end.

For gutters in long runs or for any gutters where it is not desired to have the water flow over the outside we sometimes furnish downspouts. These are generally made of galvanized iron, with copper hats where the downspout goes through the gutter. Arrangements are made for connecting up with drip conductor on the gutter. If desired we can furnish the downspout entirely of copper.

What an endless amount of worry and bother is caused by laying the glass of your greenhouse in cheap inferior putty. It is poor economy indeed to find, after a few months, that the putty on your greenhouse roof cracks and peels off causing the glass to get loose and the water to leak in. Better spend a little more and get the best putty for the best is none too good. Pure boiled linseed oil and finely ground whiting, well mixed, makes the best putty. We have it in all quantities from twenty-five pound cans to carload lots. Don't buy putty to glaze your greenhouse from your home dealer. He probably has inferior stuff and does not carry this high quality, having no call for it, as it is not used for any other purpose but glazing greenhouses.

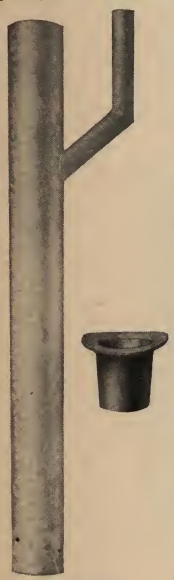


Fig. 447. Downspout

We firmly believe in erecting greenhouses of the best materials consistent with a reasonable price and above all we do not believe in skimping on little things such as hinges, putty, paint and nails. Formerly most greenhouses were built using plain steel or wire nails for fastenings the members together. This was soon found to be unsatisfactory as the nails rusted out. We have, therefore, placed on the market our galvanized nails in such sizes as are best adapted for greenhouse construction. We have these in all quantities from one pound packages up, and will figure the proper amounts and sizes needed to build your particular job. Let us send you some.

There are hundreds of different kinds of glazing points each with various good or bad qualities. We sell a number of kinds, but our "J. C. M." galvanized brand we consider the best. These points are easily handled, hold the glass firmly, are cheap and last a long time.

Fig. 444. Door Lock

Fig. 445. Door Latch

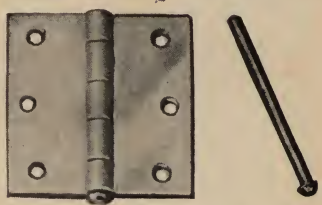


Fig. 446. Door Hinge

Fig. 448. Putty

Fig. 449. Galvanized Nails and Glazing Points.

Construction Details—Standard Patterns

Fig. 450
SHELF BRACKETS

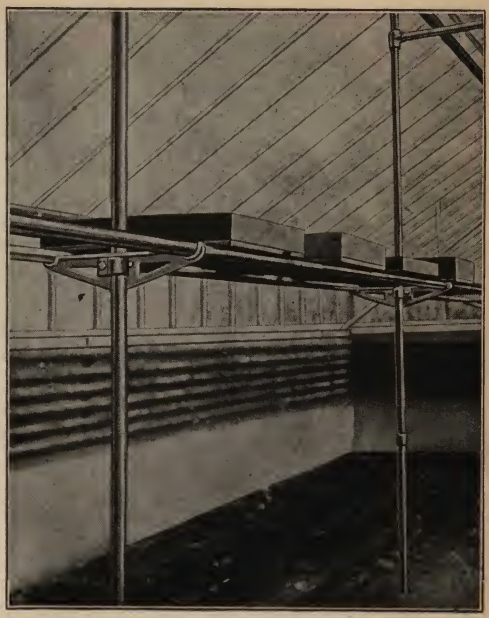


Fig. 451
SHELF BRACKETS IN GREENHOUSE

There are many times when your greenhouses are crowded with stock and extra room is needed for plants. The Shelf Brackets shown here are just the thing for you to use as they can be attached to the purlin supports or gutter posts and pipe or boards used for shelves. If the stock is in boxes it may be set on pipe as shown above and if in pots, boards may be put in. These Shelf Brackets are made of the best cast iron, are strong and durable and are so made they can be easily taken apart at any time. The collars that fit around the post are constructed in such a manner that when necessary, a bracket can be used on one side and a hook for carrying a heating pipe on the opposite side. If you put up a single shelf it can be made double at any time by purchasing an extra bracket for the other side. This also applies to our Pipe Carriers as the collars for the shelf brackets and pipe carriers are the same in design.

If brackets are used with pipe stringers as shown above when not in use you get the full benefit of the light. The 8 in. brackets are made for pipe or boards. The 12 in. brackets are made for boards only.

PRICE LIST	Single	Double.
Clamp on 1 inch to carry 8 inch board, each	$0.16	$0.22
Clamp on 1¼ inch to carry 8 inch board, each	.17	.23
Clamp on 1½ inch to carry 8 inch board, each	.18	.24
Clamp on 2 inch to carry 8 inch board, each	.19	.25
Clamp on 1 inch to carry 12 inch board, each	.18	.26
Clamp on 1¼ inch to carry 12 inch board, each	.19	.27
Clamp on 1½ inch to carry 12 inch board, each	.20	.28
Clamp on 2 inch to carry 12 inch board, each	.21	.29

Construction Details—Standard Patterns

ALL WOOD BENCHES

Fig. 452
Style No. 1

We are showing on this page two styles of benches which are used by most of the florists throughout the country.

They are constructed entirely of pecky cypress, a wood which has been found to resist decay for a longer time than any other.

In style No. 1 the legs are 4x4 set six feet apart; 2x6 stringers extending the length of the bench on top of these, and then 2x4 across at intervals depending upon the length of the bottom boards. This style enables you to use random lengths of 1x6 for bottoms.

In the No. 2 style the legs are of 4x4 lumber, the crosspieces of 2x4, or 2x6 if the bench is wider than 5 feet, and the bottoms and sides of 1x6. The posts and crosspieces are set 4 ft. apart lengthwise of the bench.

Fig. 453
Style No. 2

Construction Details—Standard Patterns

Fig. 454.
SECTION OF BENCH

Pipe Frame Benches

We illustrate here our pipe frame bench construction. It is simplicity itself and certainly durable. One cannot appreciate how clean and bright these benches really are until one has seen them actually in the greenhouse.

The bench bottoms are made of selected 1x6 pecky cypress laid across the bench and cut to fit. The face boards are made of clear cypress surfaced on both sides and neatly rounded on the upper edge. The sides are generally made of 1x6 lumber but may be any width up to 12 inches. The legs and cross pieces are made of either black or galvanized pipe as may be desired, all being cut to the exact lengths at our factory. The joints and connections are made of cast iron split fittings in two halves bolted together. No threads are needed anywhere. One inch pipe stringers extend the full length of the bench and on these the bench bottoms rest. This bench is quite portable as it is easily taken apart and set up again. The bench legs may be set on wooden stringers on the ground but it is much better to set them on concrete. As the walks are usually cement this is easily done by extending the walk a little under the bench.

The cross pieces while serving as braces afford an excellent place to rest the heating pipes on. These cross pieces may be raised or lowered as desired allowing for plenty of pitch for the heating pipes.

But two sets of vertical legs and two runs of stringers are used for all benches up to and including five feet in width; any benches wider than this are supplied with an additional leg and stringer along the center of the bench.

The cut in lower corner shows a bench in actual use and gives a good idea of its light construction. It is the best bench made for show houses, private estates and for conservatories. The first cost is considerably more than that of wood benches but it compares favorably with tile and concrete.

Fig. 456. BRACKET

Fig. 455.
BASE

Fig. 458. TEE

Fig. 457.
CROSS

Fig. 459. BENCHES IN GREENHOUSE

Construction Details

Standard Patterns

ACTUAL SIZE

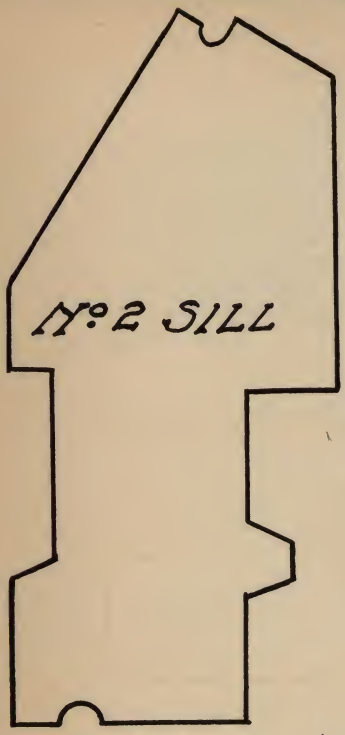


Fig. 460.

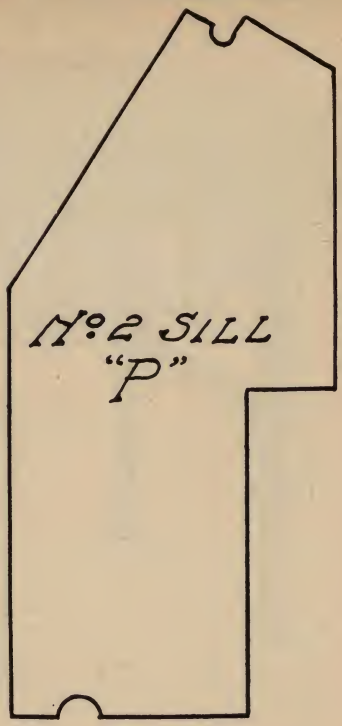


Fig. 461.

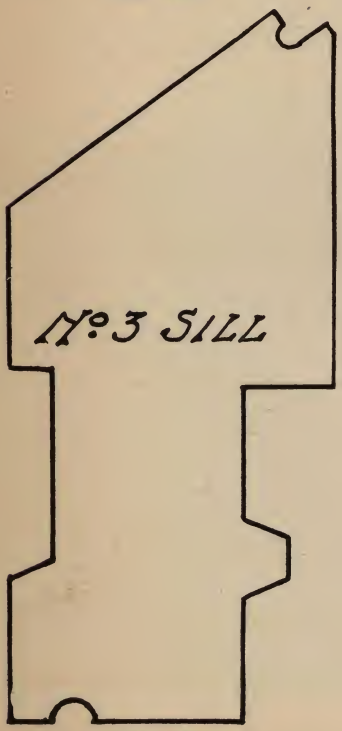


Fig. 462.

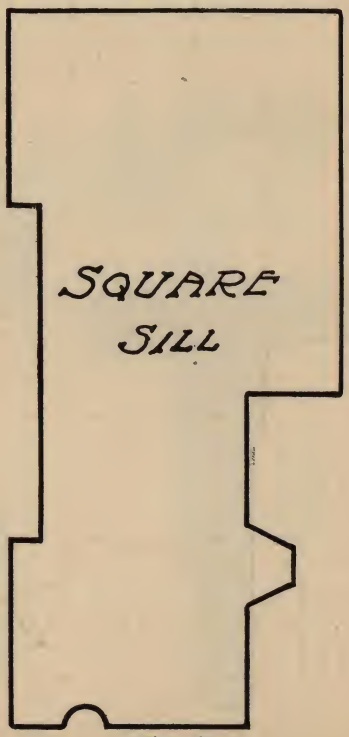


Fig. 463.

Construction Details—Standard Patterns

ACTUAL SIZE

Fig. 464.

Fig. 465.

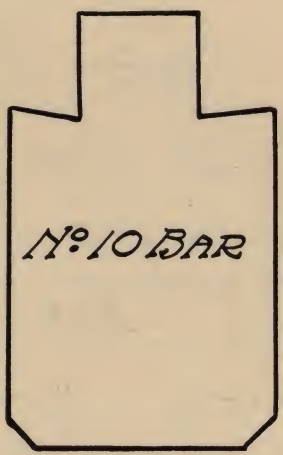


Fig. 466.

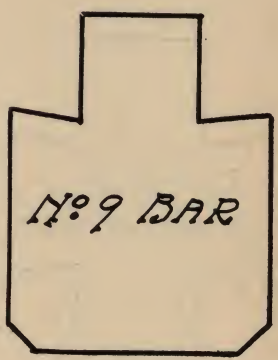


Fig. 467.

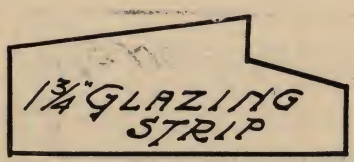


Fig. 468.

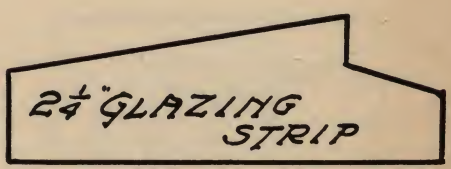


Fig. 469.

Construction Details—Standard Patterns

ACTUAL SIZE

Fig. 470.

Fig. 471.

Fig. 472.

Fig. 473.

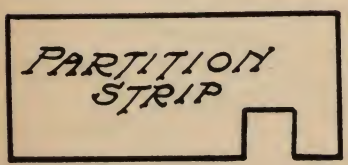


Fig. 474.

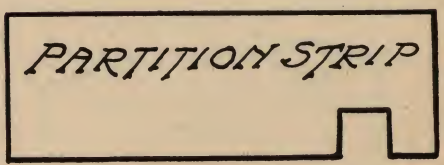


Fig. 475.

Construction Details—Standard Patterns

ACTUAL SIZE

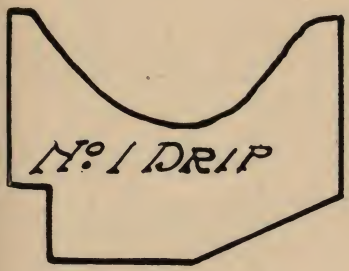


Fig. 476.

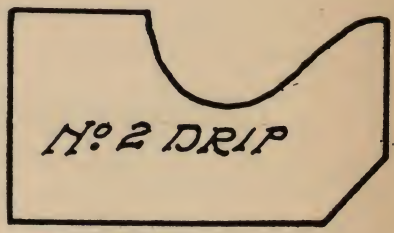


Fig. 477.

Fig. 478.

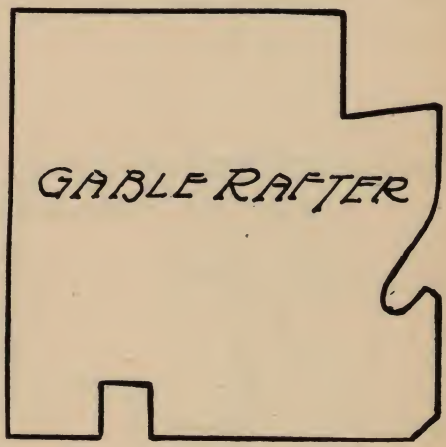


Fig. 479.

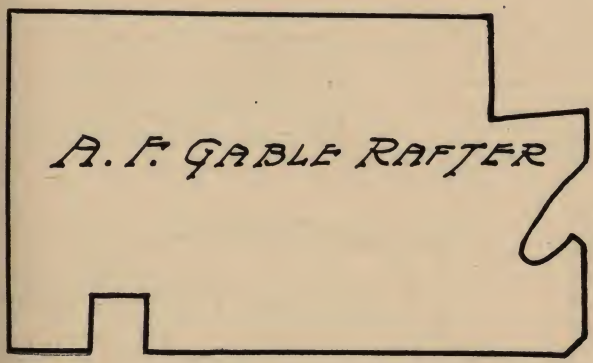


Fig. 480.

Fig. 481.

Construction Details—Standard Patterns

ACTUAL SIZE

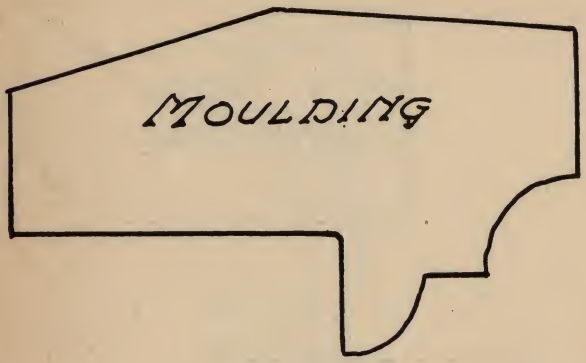


Fig. 482.

Fig. 483.

Fig. 484.

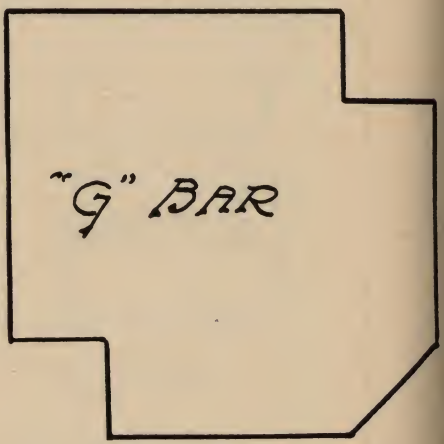


Fig. 485.

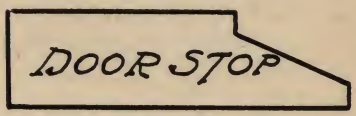


Fig. 487.

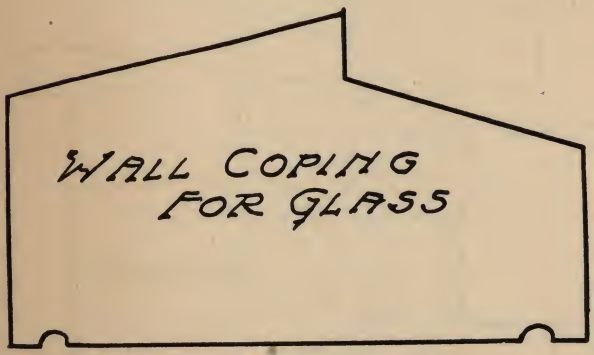


Fig. 486.

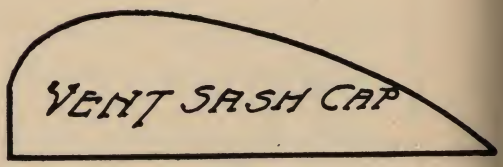


Fig. 488.

Construction Details—Standard Patterns

ACTUAL SIZE

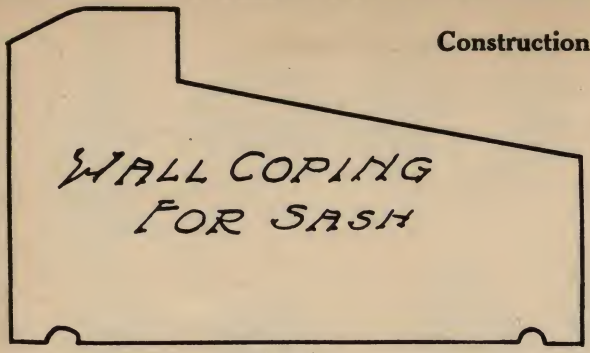


Fig. 489.

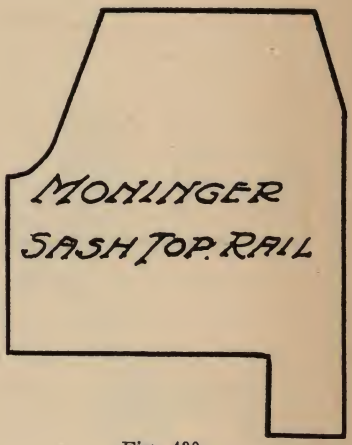


Fig. 490.

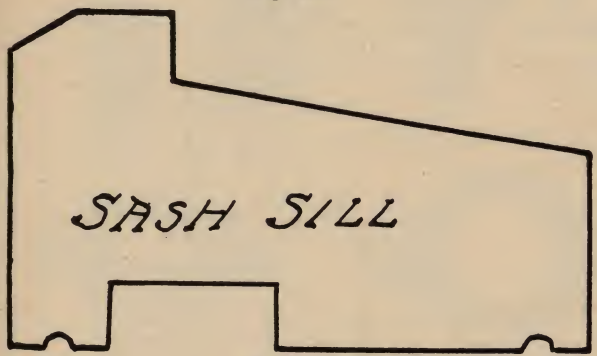


Fig. 491.

Fig. 493.

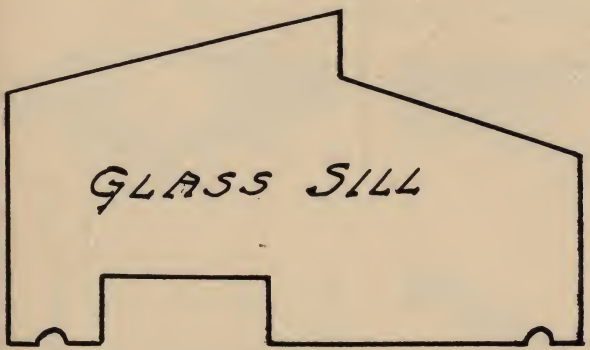


Fig. 492.

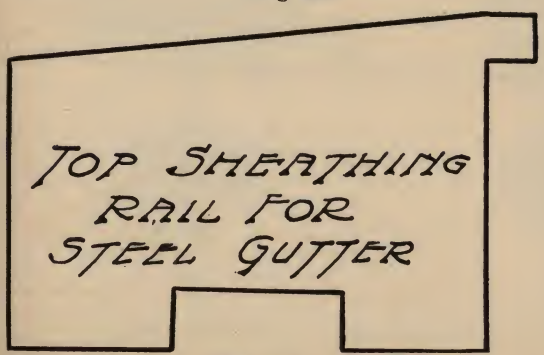


Fig. 494.

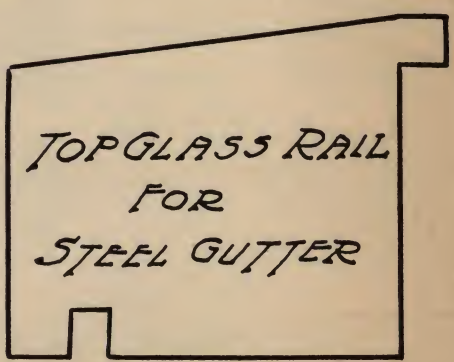


Fig. 495.

Construction Details—Standard Patterns

ACTUAL SIZE

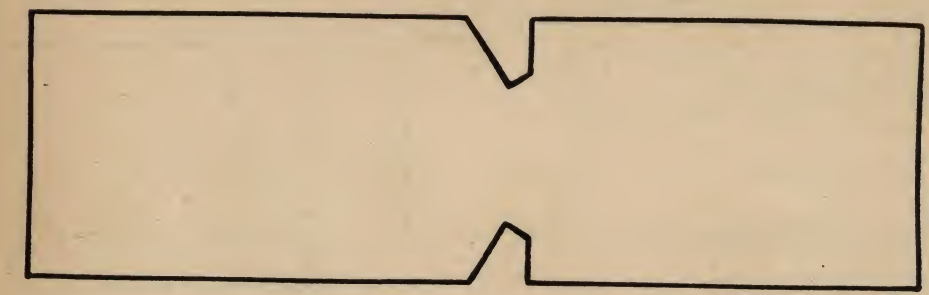


Fig. 499.

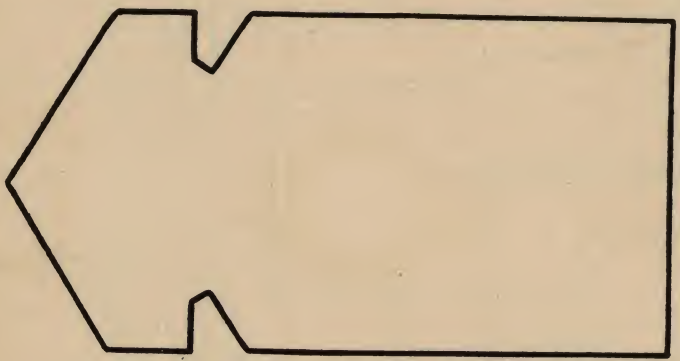


Fig. 498.

Fig. 497.

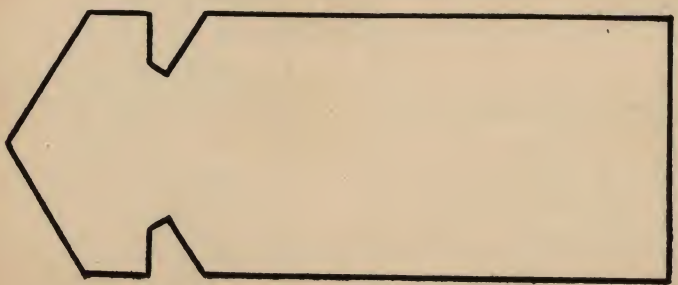


Fig. 496.

Construction Details—Fittings

500

501

502

503

504

505

506

507

508

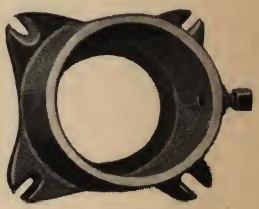
509

510

511

512

513


514

515

516

517

518

519

520

FITT INGS

Fig. 500—Purlin support fitting for flat rafter houses. 501—Ridge support fitting. 502—Pipe purlin coupling. 503—Purlin fitting for angle iron. 504—Y-Brace. 505-506—Angle iron purlin splice plates. 507—Galvanized pipe purlin clamp. 508—Shaft hanger for flat rafter houses. 509-510-511—Shaft hanger for angle iron rafter. 512—Post top fitting and bolts. 513—Down spout hub for channel iron gutters. 514—Post top fitting for boiler flues. 515—Bottom view, 518 side view: Post top fitting for channel iron gutter. 516—Bottom view, 519 side view: Post top fitting for wooden "V" gutter. 517—Bottom view, 520 side view: Post top fitting for angle iron eave plate.

Construction Details—Fittings

FITTINGS

Fig. 521—"U" bolts. 522-523—Copper splice for angle iron drip conductors with drip downspout opening. 524—Anchor bolt. 525—Clip to fasten angle iron purlin to roof bars in iron frame houses. 526-529—Sash bar bracket set for angle iron eave plate for use with A. F. bars. 527—Sash bar bracket for channel iron gutter for A. F. bars. 528—Sash bar bracket for channel iron gutter for No. 2 bar. 529-541—Sash bar bracket set for angle iron eave plate for use with No. 2 bars. 530—Angle fitting to fasten top rail to channel iron gutter. 531—Stile hinge for continuous ventilation at joint where two sash meet. 532—Stile hinge. 533—Rail hinge. 534—Loose pin door hinge. 535—Tight pin sash hinges. 536-537—Set of clips to fasten angle iron purlin to roof bars in semi-iron houses. 538—Clip used with purlin lugs on truss houses. 539—Clip to hold sash bars on flat rafter houses (used at purlin connection). 540—Clip to hold sash bars on flat rafter houses used at post connection. 542—Splice plate for face boards on benches. 543-546—Wire truss plates used on bottom of wooden gutters and eave plates. 544—Blocking clamp to fasten wooden post blocking to pipe posts. 545—Waste nut for pipe bracing for gables. 547—Sash bar splice plate for A. F. bars. 548—To fasten pipe purlins on each end to gable rafter. 549—Splice plate for No. 2 sash bars. 550—Ox bow hanger for chain to carry heating pipe. 551—Angle bracket to fasten side boards on benches to cross pieces.

Construction Details—Standard Patterns

Price List, Greenhouse Fittings and List of Standard Sizes

Item.	Page in Catalog	Figure Number	Standard Size	Price Plain	Price Galvanized	
Angle Iron Purlin Top Fittings	87	503	1″	$0.10	$0.13	Per Set
Angle Iron Purlin Top Fittings	87	503	1¼″	.12	.16	Per Set
Angle Iron Purlin Top Fittings	87	503	1½″	.14	.18	Per Set
Anchor Bolts and Washers	88	524		.04	.07	Each
Galvanized Blocking Clamps and Bolts	88	544	1½″		.07	Each
Galvanized Blocking Clamps and Bolts	88	544	2″		.07	Each
Hinges, Rail and Screws	88	533			.05	Each
Hinges, Stile and Screws	88	532			.05	Each
Hinges, Joint and Screws	88	531			.05	Each
Hinges, Plain, Tight Pin and Screws	88	535	1¾x2½″		.12	Per Pair
Hinges, Plain, Tight Pin and Screws	88	535	2½x2½″		.15	Per Pair
Hinges, Plain, Tight Pin and Screws	88	535	3 x3″		.18	Per Pair
Hinges, Door, Loose Pin and Screws	88	534	3½x3½″		.25	Per Pair
Wood Purlin Top Fittings and Bolts	72	425	¾″	.10	.13	Per Set
Wood Purlin Top Fittings and Bolts	72	425	1″	.10	.13	Per Set
Wood Purlin Top Fittings and Bolts	72	425	1¼″	.12	.16	Per Set
Wood Purlin Top Fittings and Bolts	72	425	1½″	.14	.18	Per Set
Ridge Top Fittings and Bolts	72	430	1″	.10	.13	Per Set
Ridge Top Fittings and Bolts	72	430	1¼″	.12	.16	Per Set
Ridge Top Fittings and Bolts	72	430	1½″	.14	.18	Per Set
Door Latches and Screws	76	445			.25	Per Set
Locks and Knobs with Screws	76	444		.75	1.50	Bronze
Post Top Fittings for Wood Gutter or Eave	74	439	1¼″	.16	.21	Per Set
Post Top Fittings for Wood Gutter or Eave	74	439	1½″	.16	.21	Per Set
Post Top Fittings for Wood Gutter or Eave	74	439	2″	.18	.24	Per Set
Post Top Fittings for Wood Gutter or Eave	87	514	2½″	.22	.32	Each
Post Top Fittings for Wood Gutter or Eave	87	514	3″	.25	.37	Each
Post Top Fittings for Wood Gutter or Eave	87	514	3½″	.25	.37	Each
Post Top Fittings for Wood V. Gutter	87	519	2″	.25	.37	Each
Pipe Purlin End Bearers	88	548	1¼″	.10	.14	Each
Pipe Purlin Split Couplings	87	502	1¼″	.10	.13	Per Set
Sash Bar Splice Plate for No. 2 Bar	88	549		.10	.13	Per Set
Sash Bar Splice Plate for A. F. Bar	88	547		.10	.13	Each
Split Tees	72	426	¾″	.10	.13	Each
Split Tees	72	426	1″	.10	.13	Per Set
Split Tees	72	426	1¼″	.12	.16	Per Set
Split Tees	72	426	1½″	.14	.18	Per Set
Split Tees	72	426	1 x ¾″	.10	.13	Per Set
Split Tees	72	426	1 x1¼″	.12	.16	Per Set
Split Tees	72	426	1¼x ¾″	.12	.16	Per Set
Split Tees	72	426	1¼x1″	.12	.16	Per Set
Split Tees	72	426	1½x1¼″	.14	.18	Per Set
Turnbuckles	71	424			.15	Each
U. Bolts	88	521	1½″	.07	.10	Each
U. Bolts	88	521	2″	.07	.10	Each
Waste Nuts	88	545	¾″	.05	.07	Each
Waste Nuts	88	545	1″	.05	.07	Each
Waste Nuts	88	545	1¼″	.05	.07	Each
Wire Plates	88	546	5″	.06	.08	Each
Wire Plates	88	543	13″	.10	.13	Each
Wire Plates	88	543	15″	.11	.14	Each
Bench Side Board Supports	88	551		.03½	.07	Each
Y. Brace Fittings	71	422	1 x ¾x¾″	.31	.39	Per Set
Y. Brace Fittings	71	422	1 x1 x1″	.31	.39	Per Set
Y. Brace Fittings	71	422	1 x1¼x1¼″	.32	.40	Per Set
Y. Brace Fittings	71	422	1¼x ¾x ¾″	.34	.42	Per Set
Y. Brace Fittings	71	422	1¼x1 x1″	.34	.42	Per Set
Y. Brace Fittings	71	422	1¼x1¼x1¼″	.34	.42	Per Set
Y. Brace Fittings	71	422	1½x ¾x ¾″	.36	.45	Per Set
Y. Brace Fittings	71	422	1½x1 x1″	.36	.45	Per Set
Y. Brace Fittings	71	422	1½x1¼x1¼″	.36	.45	Per Set
Y. Brace Fittings	71	422	2 x ¾x ¾″	.41	.51	Per Set
Y. Brace Fittings	71	422	2 x1 x1″	.41	.51	Per Set
Y. Brace Fittings	71	422	2 x1¼x1¼″	.41	.51	Per Set
Bench Post Bases	79	455	1″	.07	.09	Each
Bench Brackets, large	79	456	1″	.14	.18	Per Set
Bench Brackets, small	79	456	1″	.13	.17	Per Set
Split Crosses	79	457	1″	.16	.19	Per Set
Side Board Splice Fittings	88	542		.03	.05	Each
Split Tees for Benches	79	458	1″	.12	.15	Per Set
Steel Purlin Clamp and Bolts	87	507	¾″		.08	Per Set
Steel Purlin Clamp and Bolts	87	507	1″		.09	Per Set
Steel Purlin Clamp and Bolts	87	507	1¼″		.10	Per Set
Steel Purlin Clamp and Bolts	87	507	1½″		.12	Per Set
Steel Purlin Clamp and Bolts	87	507	2″		.14	Per Set
Steel Purlin Clamp and Bolts	87	507	1 x ¾″		.08	Per Set
Steel Purlin Clamp and Bolts	87	507	1 x1¼″		.10	Per Set
Steel Purlin Clamp and Bolts	87	507	1¼x ¾″		.10	Per Set
Steel Purlin Clamp and Bolts	87	507	1¼x1″		.10	Per Set
Steel Purlin Clamp and Bolts	87	507	1½x1¼″		.12	Per Set
Steel Purlin Clamp and Bolts	87	507	2 x1¼″		.14	Per Set
Steel Purlin Clamp and Bolts	87	507	2 x1½″		.14	Per Set

Fittings for Iron Frame Houses not included.
Special Prices on large quantities.
Special sizes made to order. Prices on application.

Construction Details—Special Patterns

Made to order only at prices higher than charged for Standard Patterns.
ONE-THIRD ACTUAL SIZE

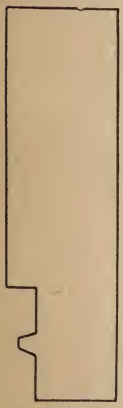


Fig. 552.

Fig. 553.

Fig. 556.

Fig. 554.

Fig. 555.

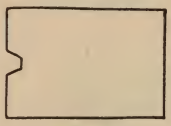


Fig. 558.

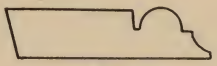


Fig. 560.

Fig. 557.

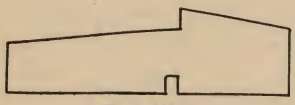


Fig. 559.

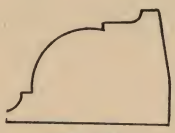


Fig. 561.

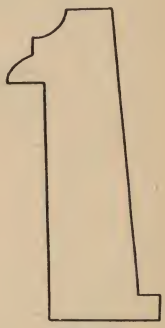


Fig. 562.

Fig. 567.

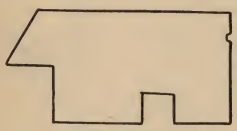


Fig. 563.

Fig. 564.

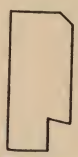


Fig. 565.

Fig. 566.

Fig. 568.

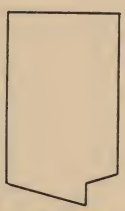


Fig. 569.

Fig. 570.

Fig. 571.

Construction Details—Special Patterns

Made to order only at prices higher than charged for Standard Patterns.

ONE-THIRD ACTUAL SIZE

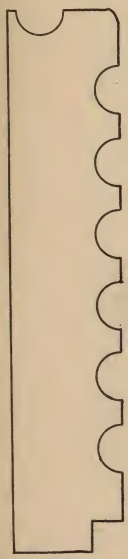


Fig. 572.

Fig. 573.

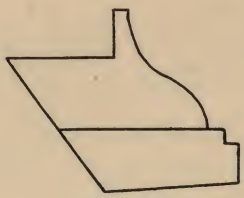


Fig. 574.

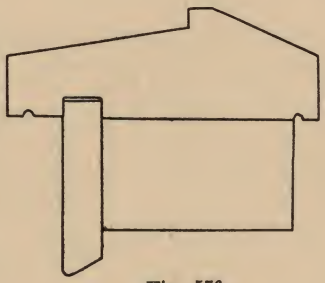


Fig. 576.

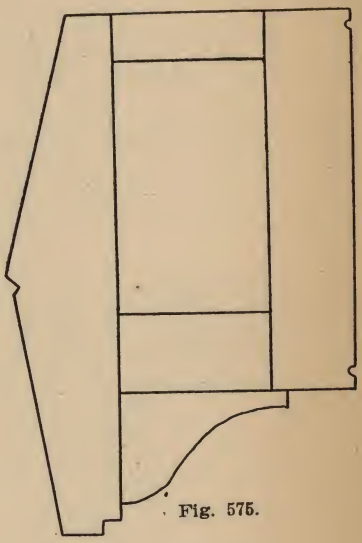


Fig. 575.

Fig. 577.

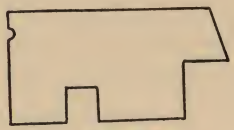


Fig. 578.

Fig. 580.

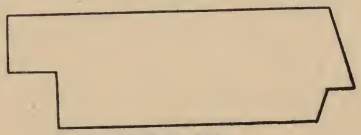


Fig. 579.

Fig. 582.

Fig. 581.

Fig. 583.

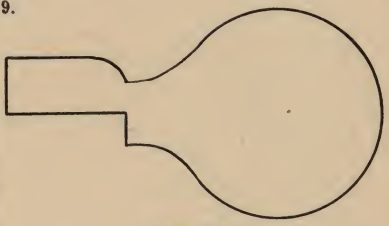


Fig. 584.

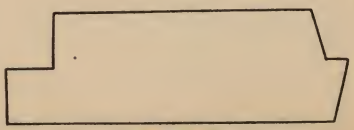


Fig. 585.

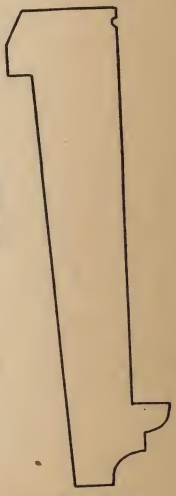


Fig. 586.

Sash Operating Machinery

For Greenhouses, Foundries, Factories, Train Sheds, Ferry Sheds, Car Barns, Auditoriums, Coliseums, Churches, Etc.

IN THIS book we are illustrating our two styles of ventilating apparatus, the "Chicago" and the "Moninger."

You will notice from the description the two types are entirely distinct and separate from each other. The Chicago device is the original ventilator lifter made by this company and the Moninger is our new Worm and Gear machine. You will be able to judge which of these types you prefer to put in after reading the following pages carefully.

The operation of both machines is very near perfect and we have thousands of each kind in use throughout the country. Some of our customers prefer one and some the other type, so it is merely a matter of choice which is the best to put in. Under certain conditions the Chicago lifter will be less expensive than the Moninger, while often the Moninger lifter can be put in for less money than the Chicago pattern.

Making, as we do, the two principal types now in use you are able to get the right machine for your house along with the construction materials from one firm. There is a great advantage in buying everything in one place, as you have only one party to do business with and you become a good customer of the company. Your order totals a larger amount when you get everything in one place.

No matter what make of construction material you are using, we are glad to supply our ventilator operators for the houses. Every order, small or large, is appreciated and will have our immediate careful attention.

The prices are low. We always have stock on hand and can ship quickly.

Sash Operating Machinery—The Chicago

The Chicago Ventilator Lifter

This apparatus is very simple in construction and built on common sense principles. It is so simple that a child can properly and easily assemble the parts. It is a practical machine made to do the work required of it. The parts are all extra heavy and the machine is the most powerful on the market.

Machine and Stander "Chicago" Fig. 587

The lifters attached to the shafting operate directly on the pipe so that nearly all leverage is eliminated and immediately you turn the handle on the machine the sash begins to open or close, as the case may be. On account of this direct action on the shaft long lengths of sash can be operated with the machine.

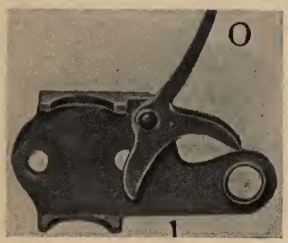
The entire apparatus is heavily galvanized by the hot process, so that rust and corrosion is practically eliminated. This makes the device very durable. We believe it is the only device on the market that is sent out completely galvanized.

Under ordinary conditions one machine will operate 125 feet of shafting. Under certain conditions a longer length can be taken care of. The machine by reversing the lifters on the shafting will operate on both sides of the roof when the sash open at the top or the ridge. It is the only machine on the market that we know of that will do this. With the lever arm machines, sash on only one side of the roof can be operated successfully.

The upright galvanized pipe post which carries the machine, connects with the shafting at the top by means of a tee into which it is screwed. This tee is bored so that the shafting passes through and is allowed to revolve in it, provision being made in the top of tee for oiling.

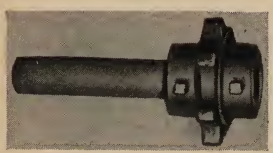
Sash Operating Machinery—The Chicago

Post Tee
Fig. 588



Machine Plate and Lock
Fig. 589

Machine Name Plate
Fig. 590



Crank Shaft and Small Sprocket
Fig. 591

At the lower end of this post is a base fitting. This base fitting is fastened to a wooden post or other foundation by means of screws and serves to hold the stander firmly in position at all times.

THE MACHINE PROPER consists of two plates, which clamp on the post, the locking device, small sprocket wheel, the crank shaft and a handle.

The two plates are placed at proper height so that machine handle can be easily reached by the person operating the apparatus and are then clamped on the post by means of two ⅜-inch bolts.

These two plates carry a ¾-inch crank shaft, to one end of which is attached a handle and to the other end a small 3-inch sprocket wheel.

On the same side of post as the 3-inch sprocket wheel a large 12-inch sprocket wheel is attached to the shafting and held in place by set screws. These two sprocket wheels are connected by a galvanized link chain, which when the handle is moved, causes the wheels to turn and the shaft to revolve, thus opening or closing the vent sash with the aid of lifters or ratchets. Only a few revolutions of the handle are required to completely raise or lower the sash.

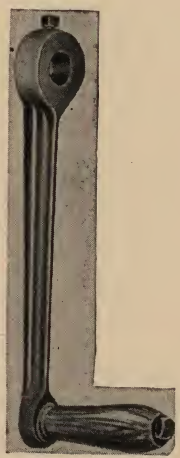
Sash Operating Machinery—The Chicago

Large 12-inch Sprocket
Fig. 592

The locking device is in two parts, viz: the lock and the lock-wheel. The lock-wheel is placed on the crank shaft between the two plates and the lock is riveted to these plates. The lock-wheel has seven teeth similar to those on an ordinary sprocket wheel and the lock, which acts much the same as a dog, engages these teeth in a manner so as to prevent the sash from closing or opening.

Lock Wheel
Fig. 592½

This locking device enables the operator to maintain the sash in any desired position without fear of their closing or being blown open.



Machine Handle
Fig. 593

The machine part is shipped assembled, so that it will only be necessary to loosen the bolts which hold the plates together, take one off, place in position on the post and then tighten the nuts again.

THE RATCHET is a toothed bar made of steel which is operated directly from the shafting by means of a small wheel having seven pins which mesh with the teeth of the ratchet.

Ratchet and Lug
Fig. 594

Sash Operating Machinery—The Chicago

Fig. 595
Wheel for Ratchets

This wheel, called the ratchet wheel, is like a collar with small pins extending from its side horizontally and is made fast to the shafting by a set screw.

Fig. 596
Shoe for Ratchet

The ratchet is held in place on the ratchet wheel by a shoe made of steel which fits over the pipe and is held in place by the ratchet. The ratchet is connected to the sash by a small lug attached with screws. All of these parts are heavily galvanized.

OTHER PARTS are the hangers, collars and the shafting.

Fig. 597
Collar for Shafting

Three collars are supplied with each machine, one for each end of the shafting, to keep it from slipping through the hanger and one to keep stander in proper place on the shaft.

Fig. 598
Hangers for Shafting

The hangers hold the shafting in place and are supplied with the ratchets according to the number of ventilators to be operated.

The shafting is made of single thick one inch pipe in coupled lengths. The couplings are not pinned, as it is unnecessary with this machine.

ORDERS for this device can be filled at once in nearly every case, and we hope we can furnish one to you.

Sash Operating Machinery—The Chicago.

Instructions for Installing Chicago Apparatus.

1st. Place hangers about 5 feet apart. Count number you have and space them evenly for the length of the shaft. If you have 21 hangers and shaft is 100 feet, they will be about 5 feet apart. If sash open at the top or ridge, put hanger on bar 3 inches below ridge to center line of shaft. If sash open at the bottom, place hanger 3 inches above header to center of shaft. Be sure all hangers are perfectly in line.

2nd. Screw lugs on the sash before sash are put on the building, if possible. If top ventilation, lugs are placed on top rail and for bottom ventilation on the bottom rail. Count the number of sash and the number of lugs and divide evenly. If you have 24 sash and 48 lugs you will have 2 lugs to each sash and they should be placed in the center of the end light in this case. If one lug to a sash, place in center of sash.

3rd. Place shafting in the hangers. As the length is put in place, ratchet wheel should be slipped over so it will come opposite the lug on the sash. Have teeth in ratchets all face one way—toward high end of shaft. Do not tighten set screw on the ratchet wheels at this time. Determine point where you wish to locate machine before shafting is coupled. Put on the large sprocket wheel, the post top fitting and a collar, on the shaft, in the order mentioned. The tee will be between the large sprocket wheel and the collar on the shaft and all of them side by side. Screw shafting together very tight into the couplings.

4th. Hang one of the shoes over each ratchet wheel.

5th. After sash are on the roof slide the long ratchet on its flat side between the shoe and ratchet wheel. When upper end reaches lug, turn ratchet on edge so teeth mesh with teeth on ratchet wheel. Push ratchet into the lug and fasten with bolt. Pull ratchet down until sash is securely closed on the roof. Hold in this position and tighten set screw on the ratchet wheel. If set screw happens to come on top of the shoe, take lug bolt out, turn ratchet on its flat side and adjust ratchet wheel until set screw comes below the shaft. Turn ratchet again on edge and attach to lug, then tighten the set screw with a small monkey wrench. It will be a good plan to try out one ratchet first so you will know just what position ratchet wheel should be in to get the set screw on the lower side of the shaft when the sash is tightly closed.

6th. Place one collar on each end of the shaft next to hanger and tighten set screw. This prevents movement of shaft lengthwise and holds it in place in the hanger.

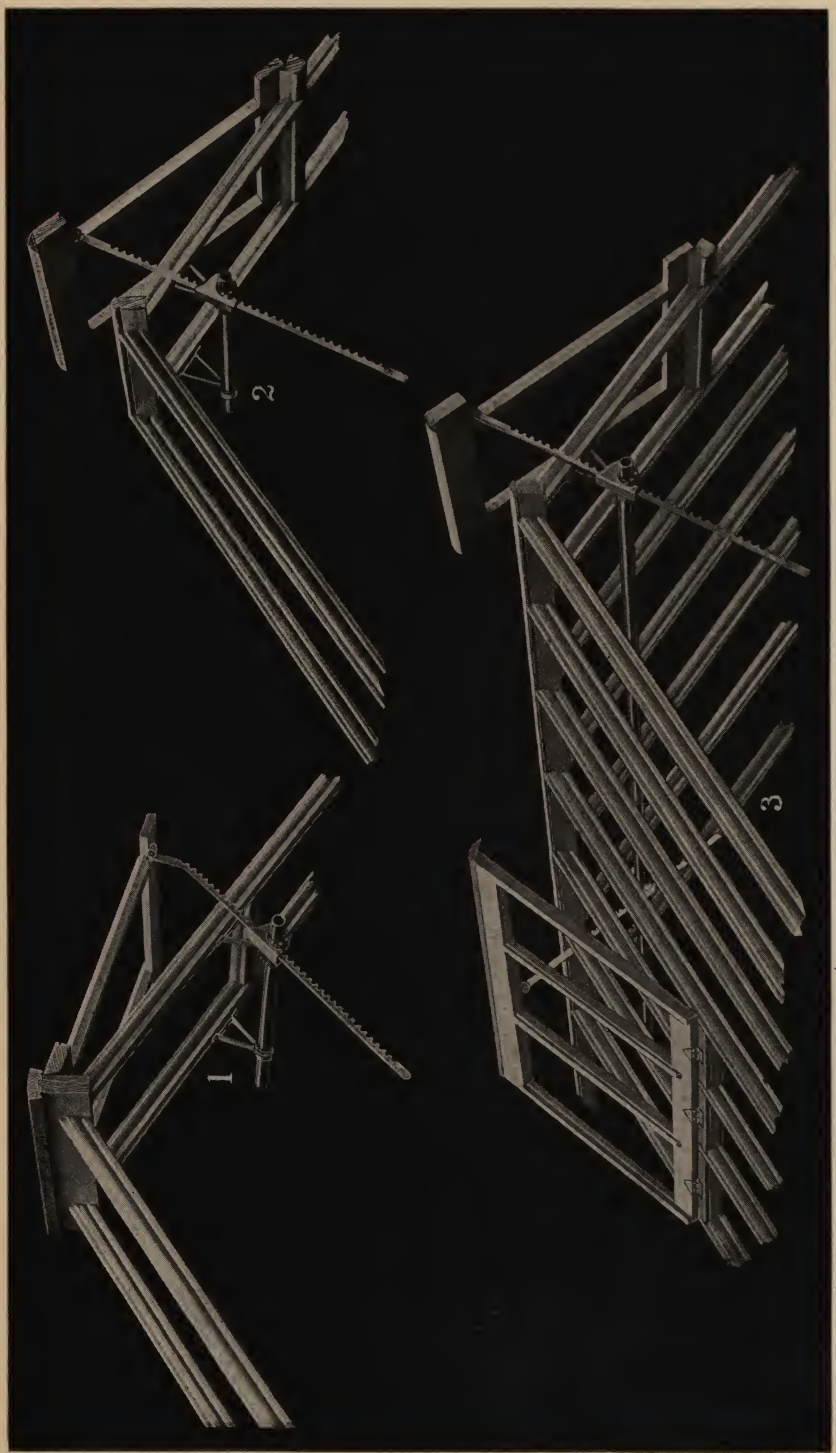
7th. Set up 1½ inch machine post attaching it to the tee on the top and to base fitting at the lower end. Move large sprocket wheel close to the tee and tighten set screw until wheel is fast on the shaft. Move collar close to tee and tighten securely to shaft.

8th. The machine part is all assembled when you receive it. Take off nuts on the bolts and place machine part on the upright post at proper height for you to operate it. Replace nuts on the bolts and tighten machine in place on the post. Do not make it too tight until chain is adjusted. Now place link chain over the large sprocket wheel on the shaft at the top and bring it around the small sprocket wheel on the machine. Chain should not be drawn tight but should be loose enough to work freely. Just a little slack in the chain will be right. Attach handle to machine and tighten with set screw.

9th. Your operator is now ready for work. Before starting, oil post top fitting on the shafting. All of the ratchets and ratchet wheels should be greased with a good grease. Axle grease is very good. It can be applied with a piece of cloth fastened to the end of a piece of wood.

If these instructions are carefully followed device will operate perfectly.

Sash Operating Machinery—The Chicago.



This cut shows position of ratchets and shafting in the greenhouse. Fig. 1 illustrates bottom ventilation. Fig. 2 shows top ventilation on one side of the roof. Fig. 3 gives ventilation on both sides of the roof opening at the top. When sash are placed in this position they can be operated with one machine and only one line of shafting. Where sash open at the header and are placed on both sides of ridge, two machines and two runs of shafting will be required to operate them.

Sash Operating Machinery—The Chicago.

The Chicago Ventilator Lifter

PRICE LIST—Chicago Device

MACHINE COMPLETE, galvanized throughout, with 10-foot iron pipe post and sufficient galvanized link chain for same, each $8.00

RATCHETS COMPLETE, including ratchet, ratchet wheel, one lug and one shoe, all galvanized, each $0.60

HANGERS, galvanized, each ..... .10

PRICE OF PARTS

Machine Parts

Locks	No. 0 each	$0.25
Machine plates	No. 1 each	.75
Machine plates (name)	No. 2 each	.75
Lock wheel	No. 3 each	.20
Stander base	No. 8 each	.25
Handles	No. 10 each	.45
Collars	No. 19 each	.10
Large 12-inch sprocket	No. 32 each	2.25
Small 3-inch sprocket	No. 33 each	.85
Tees	No. 34 each	.35
Chain	No. 35 per foot	.12
Standers 10 feet	No. 36 each	1.00

Ratchet Parts

Ratchets, straight	No. 37 each	.25
Ratchets, bent	No. 38 each	.25
Ratchet wheels	No. 6 each	.15
Shoes	No. 12 each	.15
Hangers	No. 4 each	.10
Lugs and Bolt	No. 9 each	.10

Prices on Shafting quoted on application.

The above prices are all f. o. b. Chicago, and are not subject to any discount. All prices are subject to change without notice.

THIS PATENTED DEVICE IS MADE AND SOLD ONLY BY US.

One Chicago machine will operate a run of sash about 125 ft. long. If sash open at the top and are on both sides of the roof one machine will operate them, but not independent of each other. This cannot be done where sash open at the bottom.

For every run of 125 feet figure one complete machine.

For every ventilator less than four feet long figure one complete ratchet.

For every ventilator over four feet long figure two complete ratchets.

For every five feet of length of house figure one hanger and one for the end.

Sash Operating Machinery –The Moninger.

The Moninger Ventilator Lifter

Fig. 599
Complete Machine showing Shafting, Double Action Arm and Hanger

This is our latest device and is built on what is known as the worm and gear principle. An easy, smooth, light running operator. We believe it to be without doubt the best ventilator lifter of this type on the market at this time.

For short runs of roof sash and for light work we use a machine with 1¼" post. With this machine the shafting is of one inch pipe with pinned couplings. Either the double action or the elbow arm may be employed with this outfit.

For long houses and for heavy duty the larger machine is used with 1½" post.

A new innovation for heavy work is our 1¼" shafting. This size of shaft being much stronger than the one inch, enables you to open and close the sash more evenly than with any other device made. Double action or elbow arms may be used as desired.

The cut illustrates the complete machine, the double action arm, shaft hanger and a section of the shafting.

A length of flexible, riveted steel chain engages teeth on large sprocket and is connected to a similar length of chain engaging teeth on the lower sprocket by means of flat steel rods as shown in the cut.

The worm and gear is attached to machine post plate. This plate is bolted to post with a duplicate plate by means of four carriage bolts.

The large hand wheel connects direct with the worm and gear with a piece of steel shafting and never slips.

At lower end of post a neat split base fitting is used and this can be attached to wood post or concrete footing as desired.

Sash Operating Machinery—The Moninger.

Fig. 600
Large Chain Sprocket

The large chain sprocket shown here is properly proportioned to give shafting just the right speed.

On the side of this sprocket two stops are bolted in slotted openings. These are neat in design and very strong. This arrangement enables the operator to set stops in proper place to completely open or close the sash and acts positively on the apparatus as soon as the complete operation is accomplished. The large openings in the web of the sprocket permits easy adjustment of the set screws.

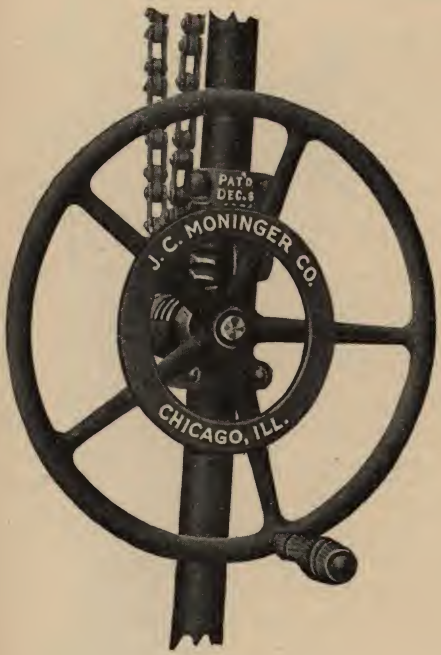


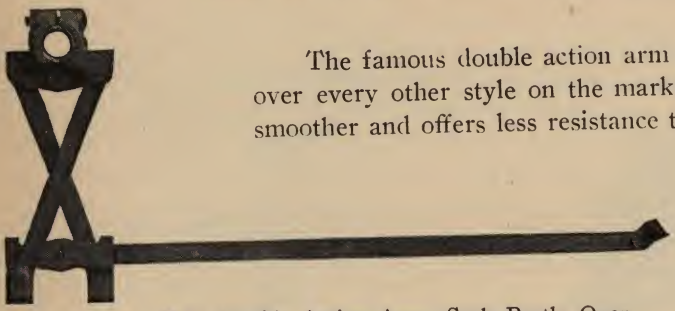
Fig. 601
Lower Operating Part of the Machine

The lower operating part of the machine is mechanically correct. The ease with which the entire apparatus can be operated is really remarkable so perfectly does each part do its work. Long runs of sash may be operated by a small boy.

The beautiful lines of the Moninger machine, its simplicity and its perfect mechanical construction is only another detail illustrating the fact that we really place on the market only goods that are a perfect finished product.

It illustrates again the aim and object of this company to sell only such goods as we ourselves would be willing to buy at the price if we were in the customer's place.

Sash Operating Machinery—The Moninger.



The famous double action arm is a great improvement over every other style on the market. Lifts easier, works smoother and offers less resistance to the shaft.

Fig. 602

New Double Action Arm—Sash Partly Open

A riveted, hinged casting clamps the shaft with one carriage bolt— simple neat and strong. All steel parts securely riveted and made as light and neat as possible consistent with proper strength. A straight pattern lug used on this arm exclusively—it's the best.

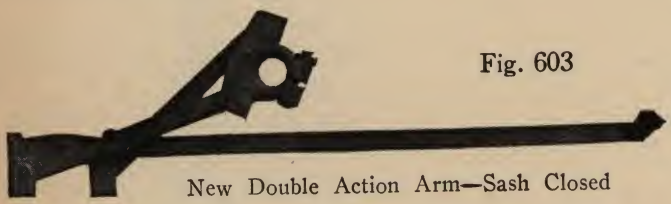


Fig. 603

New Double Action Arm—Sash Closed

Notice how the long arm enters between the lattice tongs instead of outside at the very end. This insures a rigid construction and lessens the leverage to a large extent. It is a little thing, this double action arm, but a big advance over all other lifters and you cannot afford to do without it. The price is low and it is really worth more than we ask for it if you consider the advantages it has over more expensive makes.

Fig. 604
Elbow Arm—Sash Closed

This arm made in various sizes to meet any and every greenhouse requirement.

The elbow arm is sometimes used and as this pattern has given such good service for many years we still make it. For light sash or for short houses it makes a neat easy operating arm. The elbow pattern is about the only style of arm made by other firms. You want the best you can get—so take our advice as to the pattern that will do your work right with least expense. Let us know the conditions and we will furnish you a perfect mechanism for a small amount of money—nearly always less than the other fellow asks.

Sash Operating Machinery—The Moninger.

Fig. 605
Worm and Gear attached to Machine Plate

The front machine plate carries the gear, small chain sprocket, worm and shaft. This powerful combination has been used for a number of years in various lines of mechanical work and is efficient, reliable and perfect.

The hand wheel is attached to the piece of shaft shown in the cut and is held in place by a set screw countersunk in the shaft.

Fig. 606
Machine Plates

The two machine plates are shown separate to give you an idea of the finished casting. Notice the large roomy oil case in which the worm revolves. This oil reservoir insures perfect lubrication of the gear wheel.

Fig. 607
Rollers

The two rollers are used in the post top fitting shown on next page. They lie underneath the line shaft and reduce friction to a minimum.

Fig. 608
Worm

The worm is perfectly trued from a master pattern for each machine.

Fig. 609
Angle Bracket

The angle bracket is provided with five bolt holes, so any pitch on the roof may be provided for.

Fig. 610
Gear and Sprocket Wheel

The gear is accurately cut and each one meshed with the teeth of a master gear wheel and revolved by hand before machine is assembled. It means a little more expense, but a satisfied customer is a valuable asset.

Fig. 611
Base Fitting

The base fitting clamps the post as shown. No threads to bother with. Simple, neat and perfect.

Sash Operating Machinery—The Moninger.

This illustration of the upper part of the Moninger machine is very clear and hardly needs explanation. Notice how the adjustable angle bracket is attached to the post top fitting, the reversible stops on the chain sprocket, the stop on the post top fitting and the set screw arrangement. The post top fitting is held in position on the shaft by means of a collar bolted to the pipe as shown in the cut.

Fig. 612
Upper Part of Machine

The pin end of one of the roller bearings can be seen just to the left of the nut on the collar bolt. The rollers drop into place in the post top and pins set in the slot-like openings on each side as shown in the lower cut. As the shaft revolves, the rollers turn with it and all the friction is confined to the small roller pin. This is an exclusive feature and a valuable one.

Fig. 613
Post Top

In most types no anti-friction bearings are provided and shaft grinds against the surface of the top fitting on the post. This requires power and causes wear on the parts, so that in time machine fails to operate accurately.

When the best costs no more it is folly to use the inferior machine.

Sash Operating Machinery—The Moninger.

Probably no part of a worm and gear ventilator is so important as the couplings used on the shafting. To get good results the couplings must hold the pipe perfectly rigid without play or lost motion. Even a small amount of play will cause shaft to spring and sash will not operate evenly. This lost motion carried forward from one length of shaft to another amounts to considerable in a long house and would make a difference of four to eight inches in the opening of the ventilators.

Fig. 614

Even, uniform ventilation is now demanded by every good grower and it is important to every greenhouse owner. Don't buy a ventilator of the worm and gear type until you are satisfied in regard to method of coupling the shafting.

Fig. 615

The coupling shown here is the result of many years of experimenting and it is far ahead of any other on the market. There was always trouble with every other kind, including every known make in use today, but the new pattern does the work.

Fig. 616

This coupling is attached to the shaft with four carriage bolts. Two cold steel pins are drifted in the casting and accurately fitted into two perfectly drilled holes in the shaft, so when the two halves are clamped together it makes a tight and rigid job.

Sash Operating Machinery—The Moninger.

The Moninger Ventilator Lifter

PRICE LIST PAINTED

Moninger Device

Moninger Machine, painted with 1½" post 12 ft. long	complete	$12.00
Moninger Machine, painted with 1¼" post 12 ft. long	complete	11.50
Double Action Arms, complete, for 1 or 1¼" shafting	each	.30
Elbow Arms, complete, for 1 or 1¼" shafting	each	.25
Hangers, 1 or 1¼"	each	.10
1¼" Shaft Couplings	each	.15
1" Shaft Couplings	each	.10

PRICE LIST GALVANIZED

Moninger Machine, with 1½" post galvanized	complete	$13.50
Moninger Machine, with 1¼" post galvanized	complete	13.00
Double Action Arms, complete, for 1" or 1¼" shafting, galvanized	each	.40
Elbow Arms, complete, for 1" or 1¼" shafting, galvanized	each	.35
Hangers, 1" or 1¼"	each	.15
1¼" Shaft Couplings	each	.20
1" Shaft Couplings	each	.15

PRICE LIST REPAIR PARTS PAINTED

Hand Wheel with handle	each	$2.15
Front Plate only	each	1.25
Back Plate only	each	.75
Gear Wheel	each	1.35
Small Sprocket Wheel	each	.30
Worm and Shaft	set	.85
Post Top Fittings only	each	.85
Roller Bearing for Top Fitting (2 pcs.)	set	.40
Angle Bracket	each	.35
Base, complete	set	.40
Clamp Collar	set	.20
Chain (1. long, 4' 11"—1. short, 3' 6", for each machine)	per ft.	.12
Rods (12 ft. to each machine)	per ft.	.04
Large Chain Sprocket and Stops	set	1.85
Machine Post (12 ft. long	each	1.50
Hangers for 1" or 1¼" Shafting	each	.10
Lugs for Elbow or Double Action Arm	each	.10
Collar for Arms	set	.15
Long Steel Parts for Arm	each	.10
Small Steel Parts for Double Action Arm	set	.10
Shaft Arm for Elbow Arm	each	.15

For parts galvanized, add 25% to the above prices.
Unless otherwise specified painted device will be shipped.
Price on shafting quoted on application.

HOW TO FIGURE COST OF VENTILATING APPARATUS

One machine with 1¼" shaft will operate about 125 feet of sash. Figure one machine for each side of roof. With 1" shaft half extra strong and half single strength one machine will operate 75 feet.

For every sash under four feet figure one arm.

For every sash over four feet figure two arms.

For every five feet of shafting figure one hanger and one for the end.

For each 20 feet of shafting figure one shaft coupling.

Sash Operating Machinery—The Moninger.

The Moninger Ventilator Lifter

Fig. 617
Direct Connection with Shieve Wheel and Chain

This shows one of our special machines attached directly to the roof member. It can be fastened to either wood or iron rafters when an upright post cannot be used and is a perfect mechanical device. Any of our various styles and sizes of arms may be used with this machine.

The chain carrier is a device used in nearly every skylight and factory installation. It is used to carry chain around corners. It is perfectly made and when installed operates positively with the minimum friction.

No matter how difficult the job, we can handle it and give you the right device for the purpose.

Fig. 618
Chain Carrier and Block

We have everything in the line of sash operators for every purpose.

There are many other special parts that we use for this class of work, but we are unable to show them all in this catalog. We have the patterns for nearly every part that will be required on even complicated installations, but will make special patterns and parts at any time when required.

Sash Operating Machinery—The Moninger.

Fig. 619
A Row of Monitor Sash in Operation

Fig. 620
Operating Both Sides of Skylight

Machines and Special Apparatus for Monitors and Skylights

Used in Foundries, Car Barns, Factories, Auditoriums, Coliseums, and other Buildings.

Estimates Prepared from Plans on Request.

Sash Operating Machinery—The Moninger.

Instructions for Installing Moninger Apparatus

1st. Place hangers about 5 feet apart. Count number you have and space them evenly for the length of the shaft. If you have 21 hangers and shaft is 100 feet, they will be about 5 feet apart. To locate position of hanger between the ridge and header, fasten one arm to vent sash near a roof sash bar. Close arm, with sash down on the roof, until cap on the arm is about 1 inch from the long steel rod which fastens to the sash. Place hanger on the bar so opening is in line with opening for the shaft on the arm. A short piece of pipe can be used to get opening in line. Now measure distance from ridge or header to center of first screw hole in the hanger. Set all hangers in line with the first one. Be careful to get them perfectly in line and when arms are attached, be sure all the lugs are attached in exactly the same position on the sash rail. Any unevenness will make a difference in the opening or closing of the sash.

2nd. Place shafting in the hangers. See that all of it is straight. Couple the lengths good and tight as you go along. Decide now where you wish to place the machine, whether at end of the house or in center, and put on the large sprocket wheel, post top fitting, collar and angle bracket, in the order mentioned. The hand wheel on the machine as shown on page 11 runs in the opposite direction from the large sprocket wheel on the shaft so when you place the sprocket wheel on the shaft decide which way you want the machine placed. That is, if houses run north and south, decide whether you want the hand wheel facing east or west and put on the large sprocket, post top fitting and collar accordingly. For instance, if hand wheel is to be on the west side of the post, the large sprocket will be north of the post top fitting on the shaft. If hand wheel is to be on the east side of the post, the large sprocket will be south of the post top fitting on the shaft. Now fasten angle bracket to roof bar and to post top fitting. Of course you understand post top fitting must come directly beneath roof sash bar. Fasten large sprocket securely on the shaft by tightening the four set screws firmly against the pipe. After you have turned the set screws down tight, tap them lightly on the head with a hammer and turn them just a little more. This is a necessary operation as it gives the screw a tighter grip on the shaft and locks them in place. This side of post top fitting with stop should be next to large sprocket wheel and the side with set screw away from sprocket wheel.

3rd. Place post in position inserting it in post top fitting as far as it will go and tighten set screw. Fasten lower end of post with base fitting to foundation, using either a cedar post or concrete, as desired. Now select the longest piece of chain and place it over the large sprocket wheel on the shaft dividing it evenly on each side. Rivet one end of each of the two flat rods to chain on each side. Now rivet the flat rods to each end of the short piece of chain.

4th. Place the machine on the post hanging the small sprocket on the chain which you have just put up. Tighten machine on the post just a little in about the right position. Adjust by driving machine up or down on the post until the chain and rods have been given the proper tension. Just a little slack in the chain is about right. Now fasten the four bolts which clamp the machine to the post and make them tight. Do not turn more on one bolt than on another, but tighten them up evenly, a little at the time, or you may crack casting. Place hand wheel on the shaft and tighten set screw until it enters the little socket in the shaft.

5th. Turn hand wheel on the machine in the direction that will ordinarily close the ventilator sash until the stop on the sprocket wheel strikes the stop on the post top fitting. Now fasten arms to the ventilator sash being careful to fasten each lug on each sash in the same position. Now fasten the arm to the shaft. Two bolts are used with each elbow arm, but only one bolt is used with the double action arm. Be careful to hold the sash down tight on the roof when you fasten the arms to the shaft. Arms are fastened to the sash with wood screws.

6th. Fill the oil cup under the worm wheel in the machine and oil cup under the rollers in the post top fitting half full of good engine oil and keep them half full at all times. Machine is now ready to operate.

Hot Bed Sash.

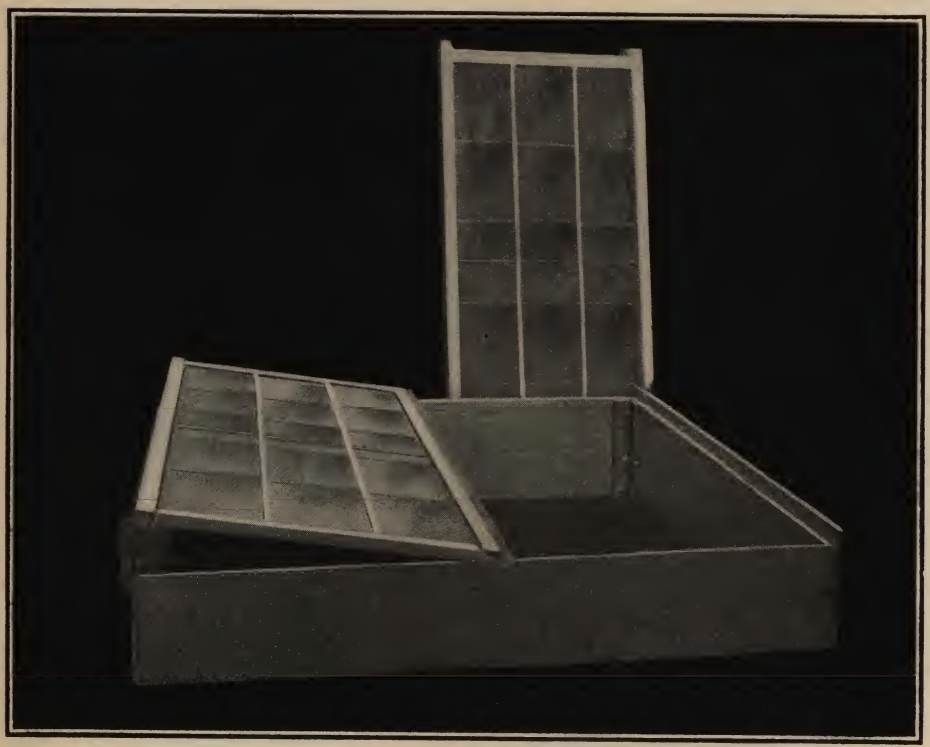


Fig. 621

"A Perfect Product"

The above shows a two sash frame complete. This frame is 10 inches high in front and 16 inches in the rear. Get our price on the frames before you. Our two sash frames made of pecky cypress are sold as low as $5.25 and $1.40 for each additional sash. This price is for the frame only.

Outfit Complete or Any Part Separate

Fig. 622

THREE-SASH FRAME COMPLETE SHOWING SASH UNGLAZED AND NOT PAINTED

This frame is 10 inches high in front and 16 inches high in the back. Corners put together with angle iron and flat head screws counter sunk. This frame is made of clear cypress, but can be made of pecky cypress with wood blocks for corners.

Frames furnished for any number of sash or any size of sash. Lowest prices always for special work of this kind. Send us complete information and let us figure with you.

MAKERS OF HOT BED SASH SINCE 1848.

Hot Bed Sash.

The Story of the Moninger Sash

The first Moninger Hot Bed Sash was made in July, 1848. It was made in Chicago, in a little one-story frame building, at the corner of Franklin and Kinzie streets. The sash was made by hand and the maker of it was Frank C. Moninger.

From 1848 to the present day there has been an effort made every year to improve the construction and workmanship of Moninger Hot Bed Sash. The old hand-made sash, with its heavy wooden dowell pins and flat braces underneath the glass, was a good sash in its time, but what a difference between the sash of 1848 and the perfect Moninger product of 1913.

During all these sixty-five years, improvements were made, experiments conducted, and practically everything ever used in sash making was tried out with Moninger Sash. The size of the wooden dowells was gradually decreased; then came the iron nals, and, finally, the barbed steel wire dowel. The flat braces were made smaller and the number of them decreased until finally the sash were braced with a round wooden dowell very much the same as they are braced today. Iron rods for braces were tried and discarded along with the blind mortise for the sash rails and stiles. From open mortise to blind mortise and back again to the open mortise, with its great strength and endurance.

You take no chances when you get a Moninger Sash. The man now in charge of our Sash Department has been with us twenty-six years. When you work twenty-six years making one thing you come pretty near knowing how to make it. He isn't an old man, either, and has kept right up with the times.

Our sash are all made with open mortise, as it is the strongest and lasts the longest. Actual tests in years of sash making have proven this. Open mortise sash made by us forty-eight years ago are in use today in Des Plaines, Illinois—a record never achieved by the blind mortise sash. The blind mortise being weak would cause sash to come apart long before the forty-eight years were up.

Sash are braced with a cypress rod through the center that extends clear to the outside of the sash. The rod lasts as long as the sash and never rusts. It is lighter than iron and it is stronger, for it goes entirely through the sash.

Hot Bed Sash.

When it comes to quality, we believe this company is the only firm making sash of cypress absolutely free of sap or defects. We guarantee this without conditions of any kind. No other manufacturer will guarantee his sash free of sap or defects. No other sash are made with this quality of lumber. Not a foot of kiln-dried lumber was ever used in our factory. All lumber is open-air dried.

Each sash that we send out is stamped "MONINGER" with a steel die. You will always know our sash by this mark.

Automatic machines guarantee perfect tenons and perfect mortises. All tenons are dipped in pure white lead and oil before sash is put together. You can depend on it all of the little things that go to make up a perfect sash have been looked after and taken care of in the Moninger Hot Bed Sash.

Anything that we ship is carefully packed and guaranteed to reach you in good condition. You will find it pleasant to do business with us.

Fig. 623

Hot Bed Sash.

Fig. 624

MONINGER ZERO HOT BED SASH.

The first Zero Sash was made in 1909 and used by Chris. Hagemann, the inventor, in Peoria, Illinois. It was an immediate success and so far superior to all other sash previously used that he decided to patent his idea. Later he came to us and asked us to make some of the sash for him. The great merit of it was at once recognized by our sash foreman and by members of this company. Finally we arranged with Mr. Hagemann to put the sash on the market. This was in 1910.

So the Zero Sash is now going on its third year. The construction of the sash was a matter which puzzled us for a long time, for it was almost impossible to make it with any of the machinery ordinarily used in the manufacture of sash. Considerable of the work had to be done by hand and this was costly. Practically all of the winter of 1910 and the spring of 1911 was spent in experimenting on tools and machines to make the sash. One improvement came after another until now we have an automatic machine to cut the notches into which each light of glass sets.

In the Zero Sash every light of glass is practically a little Hot Bed Sash all by itself. Each light of glass sets in its own notch, is held in place with its cypress strip and cannot be moved in any direction. The glazing is the same for both sides of the sash. Both sides of each pane of glass rest firmly on a solid wood foundation the entire length of the light. It is almost impossible for the air to get through. The drawing will give you a good idea of the notches and the strips which are nailed on the outside to hold each light in place.

Hot Bed Sash.

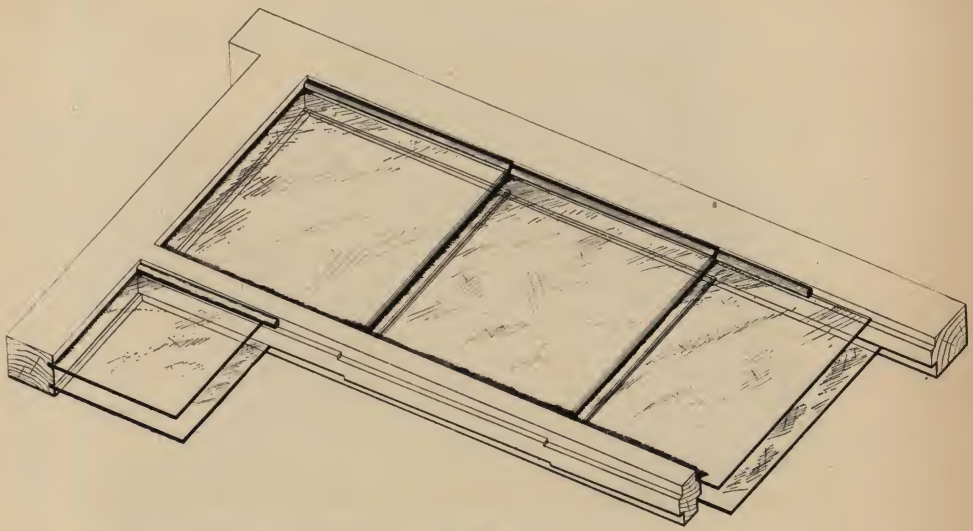


Fig. 625

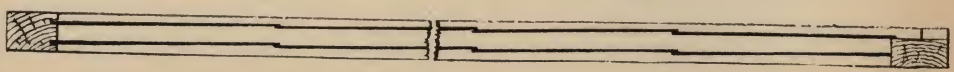
There are no little springs or clips or attachments of any kind to be used. Every light is independent and separate from the others. Repairing can be done easily and quickly. Did you ever hear of or see a sash so wonderful as the Zero and yet so simple in its construction? It is really strange that no one thought of this idea before.

If you have a Hot Bed yard you know how much trouble it is every winter to cover the sash and uncover them. If you have any other make of double glass sash you know how much trouble there is with them every fall and spring to make repairs. This little part gives out or that little thing comes loose and something must always be fixed. With the Zero Sash you can sweep snow off up or down without moving a light of glass.

Like all Moninger Sash, you will find the Zero perfect in material and in workmanship. The famous open mortise, the cypress brace through the center, barbed wire dowells, white leaded tenons and all of the little things that go to make the sash perfect.

The prices are lower than the price on any other double glass sash. You owe it to yourself to use the Zero Sash. It is really your duty to try a few of them anyway. Don't invest another dollar in double glass sash until you have tested the Zero and compared it. The Zero Sash is going to replace every other make of double glass sash in a few short years.

Why not get started now with your first Zero Sash?



Hot Bed Sash.

HOT BED SASH PRICE LIST

(Subject to change without notice.)

SINGLE GLASS SASH—Unglazed and not painted.

	1 to 10.	11 to 49.	50 to 500.
3′ x6′x1⅜″—3 rows 10″ glass. Each	$1.05	$1.00	$0.95
3′ x6′x1¾″—3 rows 10″ glass. Each	1.20	1.15	1.10
3′ 2″x6′x1⅜″—4 rows 8″ glass. Each	1.15	1.10	1.05
3′ 2″x6′x1¾″—4 rows 8″ glass. Each	1.30	1.25	1.20

For sash painted one coat Moninger guaranteed paint add 20 cents to above.
For sash painted two coats Moninger guaranteed paint add 35 cents to above.

SINGLE GLASS SASH—Glazed and painted one coat.

	1 to 10.	11 to 49.	50 to 500.
3′ x6′x1⅜″—3 rows 10″ glass, S. S. A. Each	$3.05	$3.00	$2.95
3′ x6′x1¾″—3 rows 10″ glass, S. S. A. Each	3.20	3.15	3.10
3′ 2″x6′x1⅜″—4 rows 8″ glass, S. S. A. Each	3.15	3.10	3.05
3′ 2″x6′x1¾″—4 rows 8″ glass. S. S. A. Each	3.30	3.25	3.20

For sash with S. S. B. glass deduct 10 cents per sash.
For sash glazed with D. S. B. glass add 15 cents per sash.
For sash glazed with D. S. A. glass add 20 cents per sash.
For sash painted two coats add 15 cents per sash.

ZERO DOUBLE GLASS SASH—Unglazed and not painted.

	1 to 10.	11 to 49.	50 to 500.
3′ x6′x1¾″—3 rows 10″ glass. Each	$2.05	$1.90	$1.85
3′ 2″x6′x1¾″—4 rows 8″ glass. Each	2.15	2.00	1.95

Add for painting same as on single glass sash.

ZERO DOUBLE GLASS SASH—Glazed and painted one coat.

	1 to 10.	11 to 49.	50 to 500.
3′ x6′x1¾″—3 rows 10″ glass. Each	$4.95	$4.90	$4.85
3′ 2″x6′x1¾″—4 rows 8″ glass. Each	5.05	5.00	4.95

For sash glazed with S. S. B. glass deduct 20 cents per sash.
For sash glazed with D. S. B. glass add 30 cents per sash.
For sash glazed with D. S. A. glass add 40 cents per sash.

PAINT, PUTTY, ETC.

Moninger Guaranteed White Greenhouse Paint, per gal., $2.00; 20 gal. lots, $1.90.

Moninger Metal-Kote Paint, per gal., $2.00; 20 gal. lots, $1.90.

Moninger Pure Glazing Putty, 25 lb. tins, 4½c per lb.; 50 lb. tins, 4c per lb.; 100 lb. tins, 3½c per lb.; in ½ bbls. (450 to 600 lbs.), full bbls. (850 to 1,200 lbs.), 3c per lb.

Moninger Liquid Putty, $1.40 per gal.; 5 gal. lots, $1.35 gal.

Glazing Points—J. C. M. Galvanized, per lb. 15c; 5 lbs., 65c.
Peerless, 1,000, 60c; 5,000, $2.75.
Siebert's, per lb., 40c; 7 lbs., $2.50.
Naumann's, 1,000, 80c; 5,000, $3.75.

PRICES ALWAYS THE LOWEST.

Greenhouse and Hot Bed Glass.

Fig. 626

GLASS

There are so many different grades and thicknesses and so many different brands of window glass that it takes an expert to select the right thing for greenhouse and hot bed sash work.

For some years we carried no stock of glass and bought and sold through the window glass jobbers. As a result, we had several complaints on quality, breakage, etc. We began to investigate and finally decided the only thing to do was to carry a stock of perfect goods so we would know exactly what we were selling. This put us in a position to give every customer the right glass at the right price.

You will find we have in stock, at all times, practically every size used in greenhouse and hot bed sash work. From 7x9 up to 16x24 in single and double thickness and in A and B quality. Our prices are nearly always lower than the market.

We do not stock or sell the so-called "Greenhouse A" glass. Some glass manufacturers seem to think any old thing is good enough for greenhouse work. As a rule, "Greenhouse A" is no better than a poor grade of B glass. Don't be fooled on this glass question. Every shipment of glass that enters our stock is carefully inspected by a competent expert. Unless it is up to the high standard that we have set for our glass, the shipment is refused. Several times in a season we refuse carloads of glass.

Make sure of your glass and order it here.

Greenhouse and Hot Bed Glass.

Glass Price List

Size	No. Lights in Box	Price per Box, 50 Sq. Ft. DSA	DSB	SSA	SSB
7x9	114	$4.05	$3.85	$3.00	$2.85
8x10	90	4.05	3.85	3.00	2.85
8x12	75	4.05	3.85	3.00	2.85
10x12	60	4.05	3.85	3.00	2.85
10x14	51	4.05	3.85	3.00	2.85
12x12	50	4.05	3.85	3.00	2.85
12x14	43	4.45	4.20	3.10	3.00
12x16	38	4.45	4.20	3.10	3.00
14x14	37	4.45	4.20	3.10	3.00
14x16	32	4.45	4.20	3.10	3.00
14x18	29	4.45	4.20	3.10	3.00
16x16	28	4.45	4.20	3.10	3.00
16x18	25	4.45	4.20	3.10	3.00
16x20	23	4.85	4.45	3.30	3.10
16x24	19	4.85	4.45	3.30	3.10
18x18	22	4.85	4.45	3.30	3.10
18x20	20	4.85	4.45	3.30	3.10
18x24	17	5.45	5.10	3.70	3.45
20x20	18	5.45	5.10	3.70	3.45
20x24	15	5.45	5.10	3.70	3.45
24x24	12	5.45	5.10	3.70	3.45
26x26	11	5.60	5.20	3.80	3.50

Subject to Liberal Discount.

Glazing Points.

Fig. 627

J. C. M. Galvanized

This point is at once the best and cheapest on the market. There are about 1,150 points in each pound package. Length, ¾ inch. For nailing use a straight piece of flat steel or a heavy chisel. We recommend this point as the best for all greenhouse glazing. One pound glazes 287 lights of glass.

Price, per lb.....$0.15
Price, 5 lbs..... .65

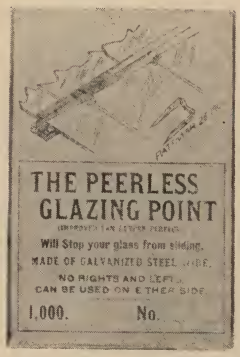


Fig. 628

Peerless Staples

The peerless was formerly known as the Van Reyper Perfect. It has been on the market for a long time and is favorably known to the trade. There are 1,000 points in each box. One box glazes 500 lights of glass. For glazing you will find our special pliers a great help.

Price, per box (1,000).....$0.60
Price, per 5 boxes (5,000)..... 2.75

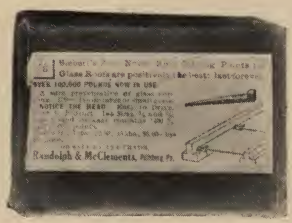


Fig. 629

Siebert's Zinc

Siebert's Zinc Point is a good one and you will like it. Being made of solid zinc, it is very durable. The ⅞ size is best for all greenhouse work. There are 1,150 of the ⅞ points in a pound package. One pound ⅞ points glazes 287 lights of glass.

Price, per lb.....$0.40
Price, per 7 lbs..... 2.50

Fig. 630

Naumann's Brass

Here is a brass point that is a great improvement over all other brass points. It is a new idea and possesses much merit. There are no rights or lefts and the points are easy to drive. They come in packages of 1,000 points. One box glazes 500 lights of glass.

Price, per box (1,000).....$0.80
Price, per 5 boxes (5,000)..... 3.75

WE CARRY ALL OF THEM IN STOCK

Paint and Putty Section.

Moninger Liquid Putty

Many florists prefer a Liquid Putty to the ordinary so-called "dough putty." With a good putty machine or bulb, Liquid Putty is easy to work and makes a nice job.

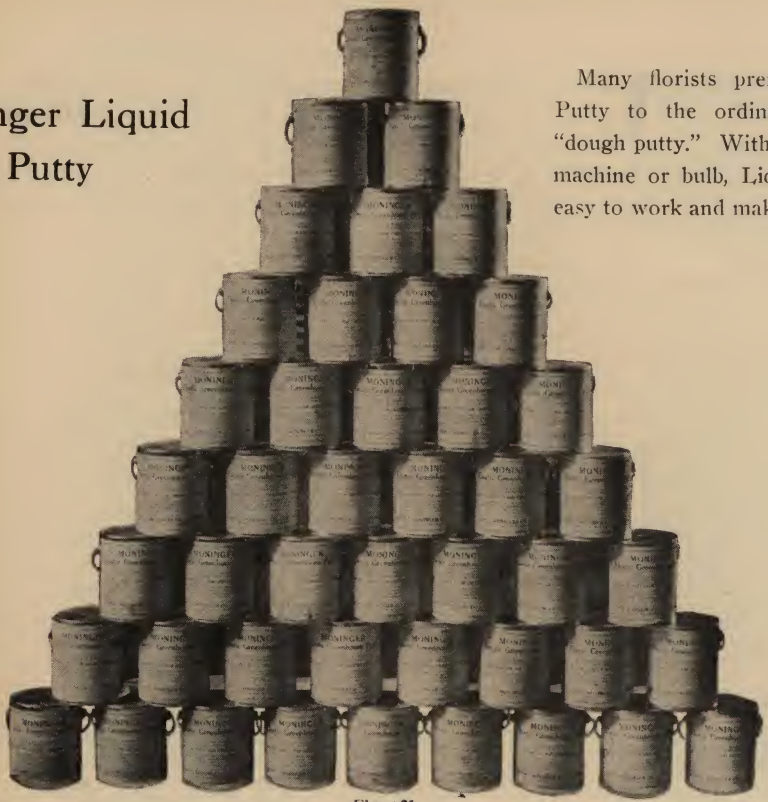


Fig. 631

The composition of Liquid Putty is entirely different from that of the ordinary putty. All formulas are more or less secret. The materials used are all of a high grade. This explains the seemingly high cost of Liquid Putty. A quantity of Liquid Putty, however, will glaze considerably more than a like quantity of the ordinary putty. When you consider area covered, the Liquid costs but little more than the other.

Our Liquid Putty is an entirely new product and is the result of many years' experience with various kinds of putty. In our opinion it is the ideal Liquid Putty. It remains elastic longer than any other putty. It contains more white lead than any other make we know of. It contains a better grade of Indian Gum (an expensive ingredient). It is made and guaranteed under our own formula. Money back or whatever you say is right if you are not satisfied with this putty.

Remember, it is not the price that counts when you buy putty. Everything depends on quality. Our price is no higher than others but you will find the putty a very superior article.

1 gallon cans, per gallon $1.40
5 gallon cans, per gallon 1.35

Paint and Putty Section.

Fig. 632

PUTTY

There are 1,001 different ways of making putty and as many different kinds. The putty on your sash or your green house is one of the very important items. Poor putty is an expensive article to use. Every pound of putty sold by us is made under our own formula printed on the packages and is absolutely guaranteed in every way.

By purchasing raw materials in carload lots we can furnish putty ready mixed for less money than you can buy the materials alone. There is no secret to the formula.

FORMULA {
Pure Spanish Whiting 83%
Pure White Lead 1%
Boiled Linseed Oil 16%
}

Your local paint man can furnish putty as low as 2 cents per pound or even lower. Beware of putty of this kind, for it is absolutely unfit for greenhouse work. Don't be misled on this putty question. Write any well known greenhouse man in whom you have confidence and ask their opinion about the kind of putty to use.

You must have putty that is absolutely pure. This is a vital matter and a few cents extra spent for good putty will save you lots of trouble and a good many dollars.

PRICE

25 lb. tins, per lb.....4½c
50 lb. tins, per lb.....4c
100 lb. tins, per lb.....3½c
½ bbls., per lb.....3c
Full bbls., per lb.....3c

Paint and Putty Section.

Beware of Imitations. The Genuine Always Bears Our Label

And Is Always One Price Everywhere

Made Only By Us Under A Patent Formula.

The Only Paint Of Its Kind

Fig. 633

PAINT

Pure White Lead and Linseed Oil makes a good paint. A large number of florists have always thought it was the best paint for greenhouse work. Pure White Lead and Linseed Oil is not the best paint for greenhouse work. This statement is made with a full knowledge of all the facts. There is a better paint for greenhouses and Hot Bed Sash than just the ordinary Pure White Lead and Oil.

You will find our paint whiter than any other you have ever used. It will not peel off or chalk like lead and oil. It covers more surface than lead and oil. It is more perfectly mixed than you can mix it by hand. It outlasts all other paint and is a better preservative for cypress. It is adapted to the peculiar conditions met with in greenhouse and hot bed work. It costs less per gallon, as it goes farther.

Like all of our products the paint is absolutely guaranteed in every way. Money back or whatever is right if not entirely satisfied. There is no secret to this formula.

FORMULA

Analysis	Pigments	Vehicles	Totals
Lead Carbonate	39%		24%
Zinc Oxide	50%		31%
Silica and Silicates	11%		7%
Linseed Oil		86%	33%
Japan Drier		8%	3%
Turpentine		6%	2%
	100%	100%	100%

PRICE.

1 gallon cans, per gallon.....$2.00 20 gallon lots, per gallon.....$1.90

Paint and Putty Section.

Paint Brushes and Glass Cutters

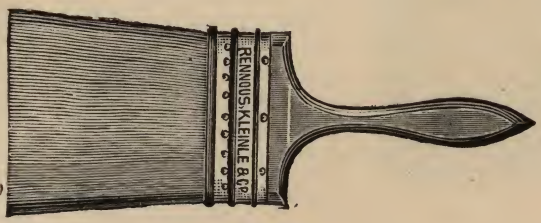


Fig. 634

XXX Pekin

Black Chinese Bristle. Solid Centre. Nickel Bound.

Width.	Length Bristle.	Per Doz.
2½ in.	2⅝ in.	$ 4.76
3 in.	2¾ in.	5.88
3½ in.	3 in.	8.12
4 in.	3¼ in.	10.20
4½ in.	3⅜ in.	12.00

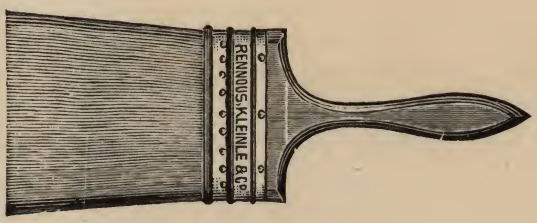


Fig. 635

Boss Painter

Good Quality Black Chinese Bristle. Solid Centre. Elastic Iong Stock. Nickel Bound.

No.	Width	Length Bristle.	Per Doz.
6	3 in.	3¼ in.	$ 9.08
7	3½ in.	3½ in.	12.04
8	4 in.	3¾ in.	15.40

Length of bristle means clear of band.

Fig. 636

Putty Bulbs

Each $0.85

Fig. 637

Putty Machines

Each $1.25

Steel Wheel Glass Cutters—Genuine "Red Devil" Glass Cutter

Finest in the World. Hand-Honed Wheels.

Fig. 638

	Per Gross	Half Gross Per Gross	Per Doz.
No. 024, Red Devil Cutters	$14.20	$16.00	$1.50

Paint and Putty Section.

Metal Kote

The Famous Iron Paint

Fig. 639

None Genuine without this Label

As the name implies, this is a metal paint and can be used for iron and steel work of all kinds. For many years it has been a problem for the greenhouse man to protect the iron parts about the greenhouse. This has been more of a problem in recent years when so many houses are built almost entirely of iron and steel. Galvanizing has done a great deal and has helped in some measure to solve this problem, but galvanizing is expensive and cannot always be used. With the need for something that would preserve the metal, we commenced making experiments and tests and after seven years, the result is our celebrated Metal Kote.

This preparation may be termed a paint but it differs from what we ordinarily call paint in many respects. The formula is necessarily a complicated one and every ingredient was carefully proportioned and figured before it was included. A little explanation of the process by which the final formula was decided on, will help to convey to you an idea of the real merit that Metal Kote possesses.

You have probably seen the mammoth ore unloaders used for unloading ore from boats. Structures of this kind were hard to protect as they were exposed to conditions conducive to rapid deterioration. The final result of every experiment to protect the steel work led to the use of black crude oil by nearly every company owning structures of this class. This proved fairly satisfactory. It was out of the question, however, to use this on steel work under other conditions, especially where fumes would be dangerous or where there would be any considerable degree of heat. This oil treatment left the surface of the steel in a semi-moist condition. The oil, however, penetrated the very small pores of the steel and, in a large measure, prevented further corrosion of rusted surfaces. Metal Kote contains a very small quantity of this oil. Its purpose in the formula is to penetrate through the outside coating of rust and stop further processes of corrosion.

In galvanizing, experts have determined that unless the mass of spelter placed on the metal covers all of the pores perfectly, rust and corrosion will proceed more rapidly than if the metal were not galvanized at all. For this reason no iron preservative can be effective unless after it is applied, a coating is formed which effectively closes the pores of the covered surface against the action of the elements. Closing the pores of the metal against the action of air and water does not mean closing it against the radiation of heat and its conductivity is lessened to no appreciable degree. This question is often brought up in painting heating

Paint and Putty Section.

METAL KOTE—Continued

pipe. Experiments along this line have led us to believe that the difference in the number of British thermal units thrown off by, 100 square feet of pipe surface normal and 100 square feet Metal Koted, is practically a negligble quantity, being less than $\frac{1}{10}$ of 1%. Metal Kote contains a preparation made from India Gum. This causes the formation of a very hard and a very perfect coat on the surface of the metal.

To give this further elasticity, there is a very small quantity of linseed oil used. To counteract the poor drying quality of the black oil, a small amount of special drier is included. This explains why the preparation dries hard in about eight hours. There are three other ingredients included in the vehicle, but the foregoing are the principal ones.

The pigment of Metal Kote is probably as important as the liquid parts. For years clear graphite has been used in metal paints of all kinds. It is exceptionally constituted by nature to withstand corrosion and will remain in its original state for great lengths of time under all sorts of conditions. Another part of the pigment is composed of black carbon. This is the same carbon you hear so much about, from coal to diamonds. These ingredients, of course, are ground very fine and when mixed with the liquid, form a smooth easy flowing paint. No preparation it seems can do without the final touch of a little lead and zinc so these two famous paint pigments are included, but in small quantities. Four other necessary minerals complete the compound.

You cannot afford to be without Metal Kote for it is cheap. One gallon covers 600 to 800 square feet of new surface. A few gallons will cover all the iron work in several greenhouses. If you have 50,000 square feet of glass you can paint practically all of your iron work including the heating system for, approximately, $50.00. We have actual proofs showing that Metal Kote increases the life of steel pipe from 80% to 100%. You cannot make money more easily than you can by using Metal Kote. You can't save it any faster or in any better way.

Metal Kote gives off no fumes, no vapor and no odor of any kind. It can be used at a temperature of 140 degrees Fahrenheit, with good results. It will not injure flowers or plants of any kind and heating pipe may be painted while the stock is growing. You take no risk in using Metal Kote.

Metal Kote is just the thing for iron posts, iron and steel gutters, iron frame houses, ventilating apparatus, iron frame benches, heating pipe, boiler surfaces, pneumatic tanks, farm machinery, bridges, windmills, steel tank towers, steel or iron purlins or purlin supports and, in fact, iron and steel work of every kind.

The paint is made in black only. A good plan is to use Metal Kote first and paint over it with any color desired.

PRICES

1 gallon cans, per gallon	$2.00
20 gallon lots, per gallon	1.90

Water Supply Outfits—Pumps and Engines.

One of the most important things about your greenhouse is the water supply. That's one thing you've got to have—water; plenty of it; when you want it.

Pumping by hand is slow, a windmill is an uncertain piece of machinery, and an elevated tank is dangerous and mighty unsatisfactory. There is always danger of freezing with an elevated tank and it is constantly leaking. There are always repairs to be made and its life is short.

This book is to tell you of a better way; a way to have a water-works of your own; a water supply system that is sure and will give you all the water you want when you want it. It's the Moninger Water Supply System.

If you have a greenhouse, you can have one of these Water Supply Systems. If you are going to build a greenhouse, you'll be glad to know that you can buy everything you need, including the water supply system, from one concern; a firm that has been in this greenhouse business for over 43 years, a firm that knows just what you need and can furnish you the best of everything, from a pound of glazing points to set the glass with, to the complete greenhouse, including the heating and watering system.

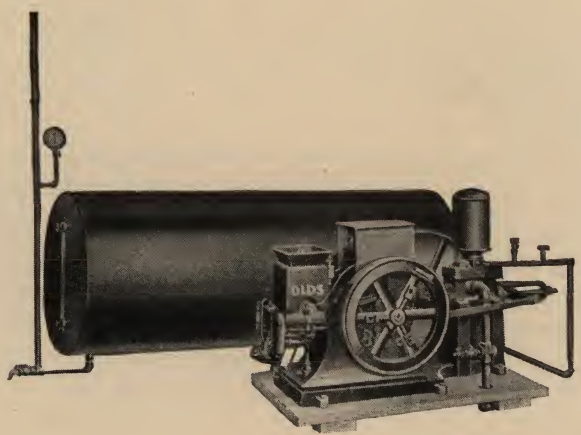


Fig 640

Water Supply Outfits—Pumps and Engines.

Pneumatic and Storage Tanks

Fig. 641

Fig. 642

Price List of Double Riveted Pneumatic Tanks

Diameter in Inches	Length in Feet	THICKNESS Shell	THICKNESS Heads	Approx. Wts.	Capacity in Gallons	LIST PRICE
24	5	3-16	5-16	425	120	$ 55.00
24	6	3-16	5-16	445	145	58.00
24	7	3-16	5-16	510	170	63.00
24	8	3-16	5-16	560	175	68.00
24	10	3-16	5-16	675	245	74.00
30	5	3-16	5-16	495	180	64.00
30	6	3-16	5-16	560	220	70.00
30	7	3-16	5-16	625	255	75.00
30	8	3-16	5-16	700	295	88.00
30	10	3-16	5-16	870	365	102.00
30	12	3-16	5-16	900	440	115.00
36	5	3-16	5-16	675	265	85.00
36	6	3-16	5-16	750	315	92.00
36	7	3-16	5-16	825	365	102.00
36	8	3-16	5-16	900	420	112.00
36	10	3-16	5-16	1050	525	131.00
36	12	3-16	5-16	1200	630	141.00
36	14	3-16	5-16	1400	735	148.00
42	8	1-4	3-8	1450	575	135.00
42	10	1-4	3-8	1650	720	150.00
42	12	1-4	3-8	1900	865	196.00
42	14	1-4	3-8	2200	1000	219.00
42	16	1-4	3-8	2400	1150	236.00
48	12	1-4	3-8	2320	1130	250.00
48	14	1-4	3-8	2610	1300	274.00
48	16	1-4	3-8	2900	1500	304.00
48	18	1-4	3-8	3600	1700	351.00
48	20	1-4	3-8	3950	1880	393.00
48	24	1-4	3-8	4650	2260	437.00

EXTRAS

Manheads.....	$15.00	Water Gauges....	$2.00
Handholes.....	7.00	Pressure Gauges...	2.00

Discount on Application

The following is a price list covering wooden tanks made from 2″ fir and 2″ clear tank grade cypress. These prices do not include covers or bottom supports.

Feet, Diameter	Length of Staves	Gallons Capacity	Weight	2″ Fir	2″ Cypress
5	5	572	550	$ 33.35	$ 38.55
	6	700	640	36.30	43.70
	7	800	730	40.75	47.45
6	5	850	700	34.80	41.50
	6	1000	800	38.55	45.90
	7	1200	900	43.00	51.50
	8	1400	1000	48.15	57.00
7	5	1150	850	43.70	51.85
	6	1400	970	45.90	55.20
	7	1695	1100	51.10	60.75
	8	1955	1220	56.30	68.15
8	6	1904	1100	53.00	63.70
	7	2250	1250	60.00	71.85
	8	2596	1400	65.20	78.55
	9	2942	1530	71.85	86.70
	10	3288	1670	78.55	94.80
9	8	3315	1570	77.00	91.85
	9	3760	1730	84.45	100.75
	10	4200	1900	91.85	109.60
10	8	4125	1790	88.90	108.15
	9	4675	1960	97.75	118.50
	10	5225	2130	105.00	128.90

All dimensions are outside. Tanks are made straight without taper. Round adjustable hoops are furnished with these tanks.

Prices on tank towers on application.

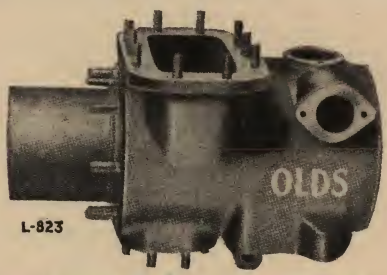
WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

The things that make Olds Engines good engines

The cylinder and piston

THE PARTS of an engine on which its life depends are the cylinder and piston; here's where a lot of wear comes; no other parts move so fast or have so great a load. There is just as much difference in the material and design of these parts as in the material and design of any other thing.

Olds cylinders and pistons are made from iron mixed according to a famous formula which has been thoroughly tried and found to be the best way to make the material for these important parts. The iron is just right, just the same every time; no luck or guess work to it, and as it is very fine grained, it isn't long before the cylinders become very smooth and hard.

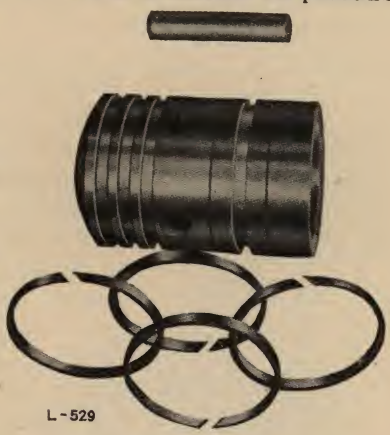


Then there's the construction of the cylinder; that's an important thing, too. You know something about the cylinder with the head bolted on, like on a steam engine. No joint can possibly hold out a great while under the high pressure of the gases in the cylinder and the intense heat; it will blow out and leak in time. No such joints in the construction of the Olds Engine; the cylinder head is cast as a part of the cylinder—all one piece—it can't leak. This means a great deal to you.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Most manufacturers bore their cylinders; they cut the metal out and bring the hole to the proper size with big, powerful, steel knives in big, powerful machines, and Olds cylinders are made that way, too. But before the exact size is reached a very delicate machine is used, which grinds the cylinders to exact size with an emery wheel. You know how an emery wheel acts—if there's a spot that is just the small part of $\frac{1}{1000}$ of an inch too high, the emery cuts it off as it passes. The result is a perfect surface; just as true as any modern machine can make it; and all through our shops where Olds Engines are made, you'll find the most modern machines that can be bought.

There are a number of different kinds of pistons, but really the Olds is the best of them all. Olds pistons are made longer than the stroke of the engine with the piston pin in the center so the wear is evenly distributed over the entire surface. The Olds cylinder and piston are horizontal, they lie flat—and with an oil cup on top of the cylinder, and with carefully worked oil grooves in the piston passing back and forth under the oiler, you can see for yourself that every part of that cylinder and piston is going to be evenly oiled—not too much or too little—just enough.


L-529

The governor

The governor used on Olds Engines is just as simple as a governor can possibly be; easy to adjust to any

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

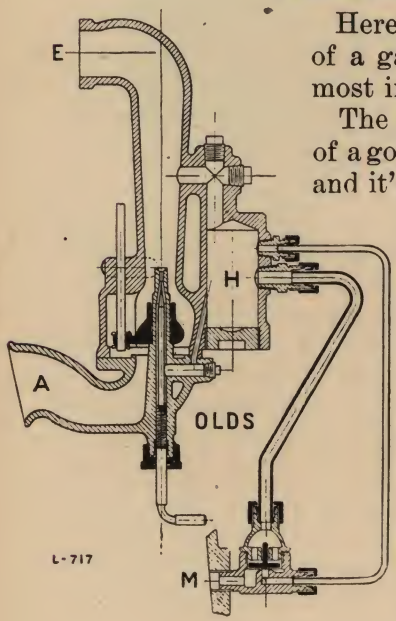
speed you want, even while the engine is running, by just turning a thumb screw; that's all there is to it.

With this kind of a governor you can run your different kinds of machines at just the proper speeds without changing the pulleys; run them smoothly, evenly, and without any waste of gasoline.

If a spring should break on the Olds governor, the governor stops the engine itself; doesn't let it run away.

The Seager mixer

(Patented February 14, 1911)



Here's a mighty important part of a gasoline engine—one of the most important parts; the mixer.

The Seager Mixer is the result of a good many years of experience and it's really the biggest advance that has been made in engine building.

This mixer is a funnel shaped tube which carries the mixture of gasoline and air to the cylinder; and it mixes the air and gasoline in just exactly the right proportions to get the greatest possible power from the engine; and it does it every time; the amount of gasoline in the sub-base does

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

not affect it—the mixer reservoir holds a constant level of gasoline—the mixture is always the same.

There is not a moving part to the Seager Mixer. The mixer will do the work it has to do just as well in twenty years as it did the day it was made; there is absolutely nothing to wear out.

There is only one adjustment—the needle valve; it is opened when the engine is started and controls the gasoline supply.

There is no pump to leak or give you trouble; the piston acts as the pump.

The making of the mixture is mechanical; it does not depend upon the heat. This means that an Olds Engine will start easily on a cold, frosty morning—just as easily in winter as in summer.

No other engine can have this mixer; it belongs to the Olds Engine.

The jump spark system of ignition

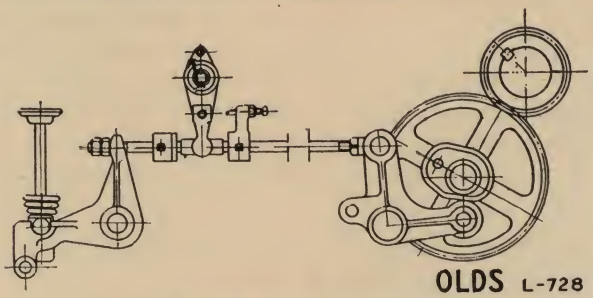
This system of ignition is used on Olds Engines because it's the best system there is for gasoline engines. It's the system you'll find in all automobiles.

It's adjustable to make the spark at any time—to get the greatest possible power and to make the shortest spark and save your battery. When you once adjust the spark to your requirements, it stays adjusted. There's not a single part that can wear enough to change the timing.

L-678

The jump spark system of ignition on all Olds En-

gines is absolutely the best, the simplest and the surest system there is for this purpose; if there was any better, you'd find it on the Olds.



Valve mechanism

This is what opens and closes the valves and you've got to be sure that it works right so that you can be sure that the valves will open and close when they ought to so your engine will run the way it should.

The Olds valve mechanism is the most simple, durable and efficient that you'll find on any engine—you can see for yourself by just looking at this picture how the gears turn around raising and lowering the valves. All adjustment is made at one point—the two nuts at the left hand end of the horizontal rod—just turn them—you don't need an expert to do it.

The inlet valve

In the Olds Engine the inlet valve is in a cage; not a part of the cylinder head. The cage is easily removed making both the inlet and exhaust valves easy to get at for examination or cleaning.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Connecting rod

L-639

The I-beam shape connecting rod is used in all Olds Engines; greatest strength with least weight; cannot spring or buckle. It has adjustable bearings at each end. Split bronze piston pin bearing; lubricated by sight feed cylinder oiler. The crank shaft end is a two-piece box babbitted with genuine Babbitt metal. Both bearings are hand scraped to exact fit; easily adjusted to wear.

Crank shaft

L-516

The crank shaft is a drop forging; without welds of any kind. Twice as strong as the ordinary bent crank shaft. Costs more to make this kind but it lasts long enough to make up for that.

Crank shaft bearings are big and lined with genuine babbitt; the best material in the world for bearings.

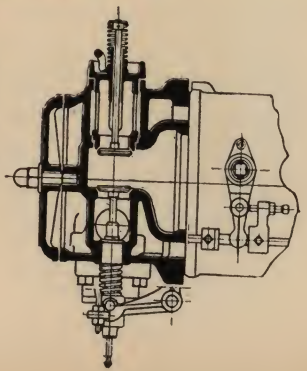
Sub-base

L-677

The Olds gasoline tank is in the sub-base, a box of solid cast iron. Safest place for the gasoline tank. Thick enough so it will not break or leak. In one end is a trap that catches all of the dirt and water from the gasoline; gives you clean gasoline going to the mixer; no other engine has it.

The valves

You can remove either the inlet or exhaust valves of an Olds Engine without disturbing the adjustment of the valve mechanism; you can't do that with other designs.



Cooling

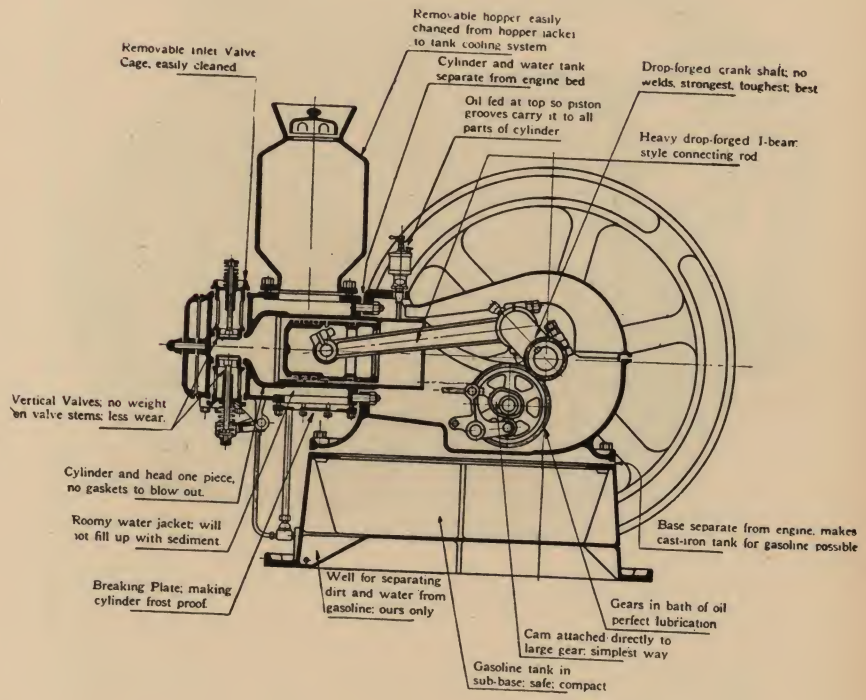
THIS cooling question is one that has been given a good deal of study and the result is that nearly all Olds Engines are water cooled. Of course, the man who wants an air-cooled Olds Engine can get it, but the water-cooled engine is always recommended because it has been found to be the best and safest. The danger of freezing in a properly designed water-cooled engine cannot be compared with the danger of overheating in the best air-cooled engine made.

All water jackets on Olds type A Engines whether closed or hopper style are made either entirely separate from the cylinder or with removable breaking plates. You can see why. Suppose the water was allowed to freeze in a jacket that was part of the cylinder. It would be a pretty expensive accident; the cylinder is one of the most expensive parts of an engine, while breaking plates that give 'way before the strain can injure the cylinder, cost but little and can be easily replaced.

Whether you need a hopper jacket engine or one with a separate galvanized iron cooling tank depends upon what you expect to do with it—it's merely a matter of equipment anyway—the engines are the same except in the construction of the water jacket.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Sectional view of Olds Engine

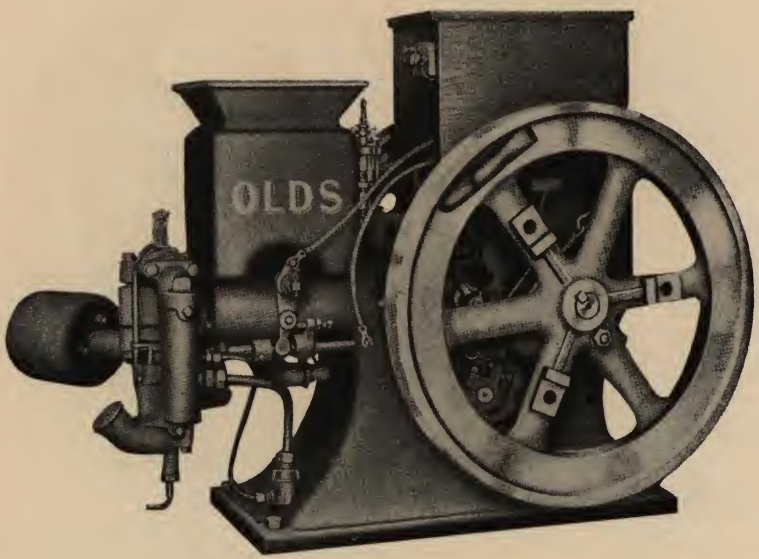


YOU won't find in any other engine so many points of advantage, so many points of superiority, so many points that mean so much to you.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

1½ horse power Olds Engine

a time and money saver



Power: 1½ horse power.
Weight: 870 pounds, ready for shipment.
Floor space: 16 inches by 31 inches.

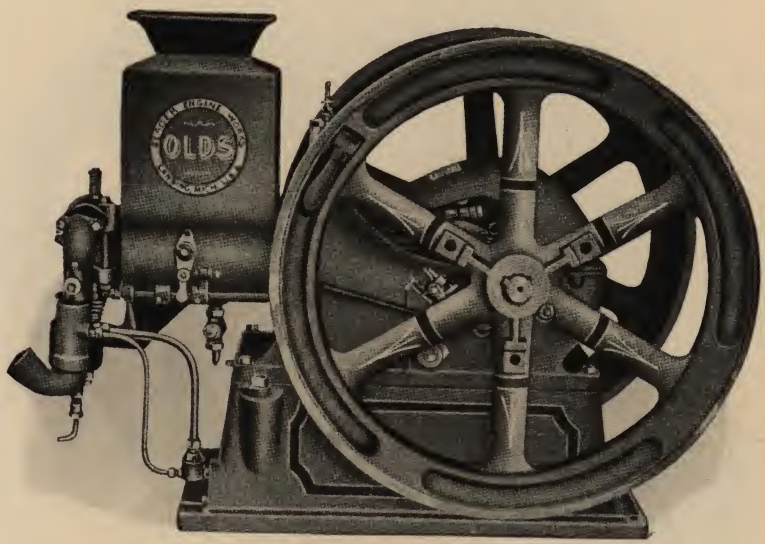
YOU see here the governor side of the Olds Hopper Jacket 1½ horse power engine; the smallest Olds Engine.

This little engine is a wonder; it will do a great deal more than you'd expect of it. Has a hopper jacket, Seager mixer, valves in cages, cylinder head cast to cylinder, etc; the things that make Olds Engines good engines.

You'll find this a mighty good pumping engine; it's big enough for the average pumping requirements.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

3 and 4½ horse power Olds Engine with hopper jacket



Power: 3 and 4½ horse-power.
Weight: 3 horse-power, 735 pounds ready for shipment.
4½ horse-power, 1070 pounds, ready for shipment.
Floor Space: 3 horse-power, 26 inches by 40 inches.
4½ horse-power, 30 inches by 46 inches.

THE picture here shows our 3 horse-power and 4½ horse-power Olds engine with hopper jacket as well as a picture can.

You can't find a better engine than this for your water supply system; especially if you want to use the engine for any other sort of work about your place. It's got the separate water jacket from which the water can be drawn if there is any danger of freezing. And even if the water should be allowed to freeze, the water jacket would break without injuring the cylinder at all; it don't cost much to replace the water jacket, but it would cost a good deal to replace a cylinder.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Governor side of Olds 8 horse power Engine, with removable hopper

Made in 6, 8, 12 and 15 horse-power sizes.

Power	Shipping Weight	Floor Space
6 horse-power.	1,430 pounds.	32 inches by 49 inches.
8 horse-power.	1,770 pounds.	32 inches by 54 inches.
12 horse-power.	2,560 pounds.	39 inches by 63 inches.
15 horse-power.	2,600 pounds.	46 inches by 75 inches.

YOU can see for yourself by simply looking at this picture the simplicity and strength of Olds Engines; easy to operate; do more than you expect of them.

The engine has a removable hopper which can easily be taken off and, by putting a plate in its place, the engine can be changed into a closed water jacket engine to be used with a circulating tank.

All Type A Engines are provided with removable breaking plates so that, in the event of freezing, these plates will break before the cylinder can be injured and they can be easily and cheaply replaced.

This is an exclusive feature of the Olds Engine, but only one of the things that make Olds Engines, by far, the lowest in cost in the long run.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Double-Acting Piston Vacuum Pump for Vacum Heating Systems

Horizontal Type

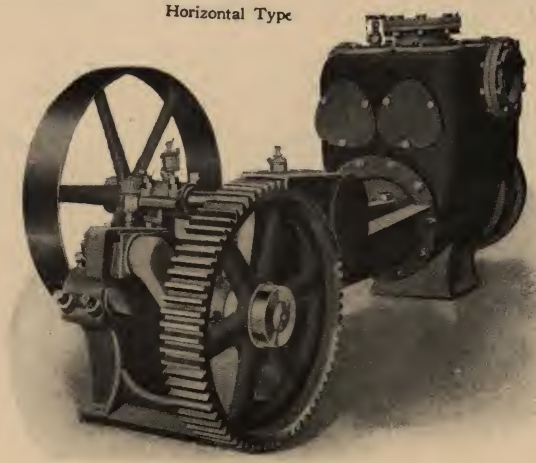


Figure 1049. Size 16"x16".

Dimensions and Capacities

Gallons Displacement per minute	Pistons		Displacement 1 Rev. o Crank Shaft	R. P. M.	Sizes of Pipe		Geared	Slagle Pulley Inches	Cipher
	Diameter Inches	Stroke Inches			Suction Inches	Discharge Inches			
170	8	10	4.28 gals	40	5	5	4 to 1	30 x 4	Zukot
265	10	10	6.73 "	40	5	5	4 to 1	30 x 5	Zukpe
385	12	10	9.72 "	40	5	5	4 to 1	30 x 5	Zukti
525	14	10	13.22 "	40	6	6	4 to 1	30 x 5	Zukuv
700	14	14	18.51 "	38	6	6	4 to 1	36 x 6	Zukxo
1000	16	16	27.82 "	37	6	6	4 to 1	36 x 6	Zukyw
1350	18	18	39.31 "	35	10	10	4 to 1	42 x 8	Zular

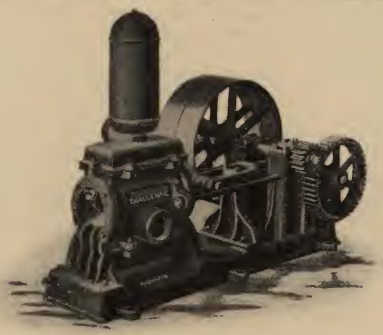


Figure 824½. "Challenge" Pump
Type of the 6x5-inch and smaller sizes

Dimensions, Speeds, Capacities, Prices Goulds "Challenge" Pumps
Figure 824½

Piston					Sizes of Pipe						Brass-Lined Cylinder		Brass Cylinder		*All Brass	
Inches Diam.	Stroke Inches	Gallons Capacity One Rev. of Crank Shaft	Gallons Capacity per Minute at 40 Rev.	For Elevation No. Feet	Suction Inches	Discharge Inches	Geared	Tight and Loose Pulleys Inches	Approximate Weight in lbs.		Cipher	Price	Cipher	Price	Cipher	Price
2¼	4½	.184	7.36	175	1¼	1	4 to 1	20 x 3	300	Xysvi	$85.00	Xytja	115.00	Xytzu	150.00
3	4½	.267	10.70	175	1½	1¼	4 to 1	20 x 3	308	Xysyf	90.00	Xytme	120.00	Xyvab	155.00
4	4½	.48	19.20	150	1½	1¼	4 to 1	20 x 3	317	Xyszo	95.00	Xytod	130.00	Xyvec	170.00
5	5	.833	33.30	150	2	1½	3 to 1	20 x 4	595	Xytaz	125.00	Xytri	175.00	Xyvfa	260.00
6	5	1.20	48.00	150	2½	2	3 to 1	20 x 4	653	Xytdy	150.00	Xytuf	220.00	Xyvid	320.00
7	6	1.96	78.40	100	3	3	4 to 1	24 x 4	1000	Xyteb	275.00	Xytvo	425.00	Xyvje	550.00
8	6	2.58	103.20	100	4	4	4 to 1	24 x 4	1025	Xytic	300.00	Xytyg	500.00	Xyvmi	650.00

* All brass pumps have all parts of brass except bed plate and driving parts.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

The Pyramid Pumps

For 75 Pounds Working Pressure or 175 Feet Elevation
For General Water Supply

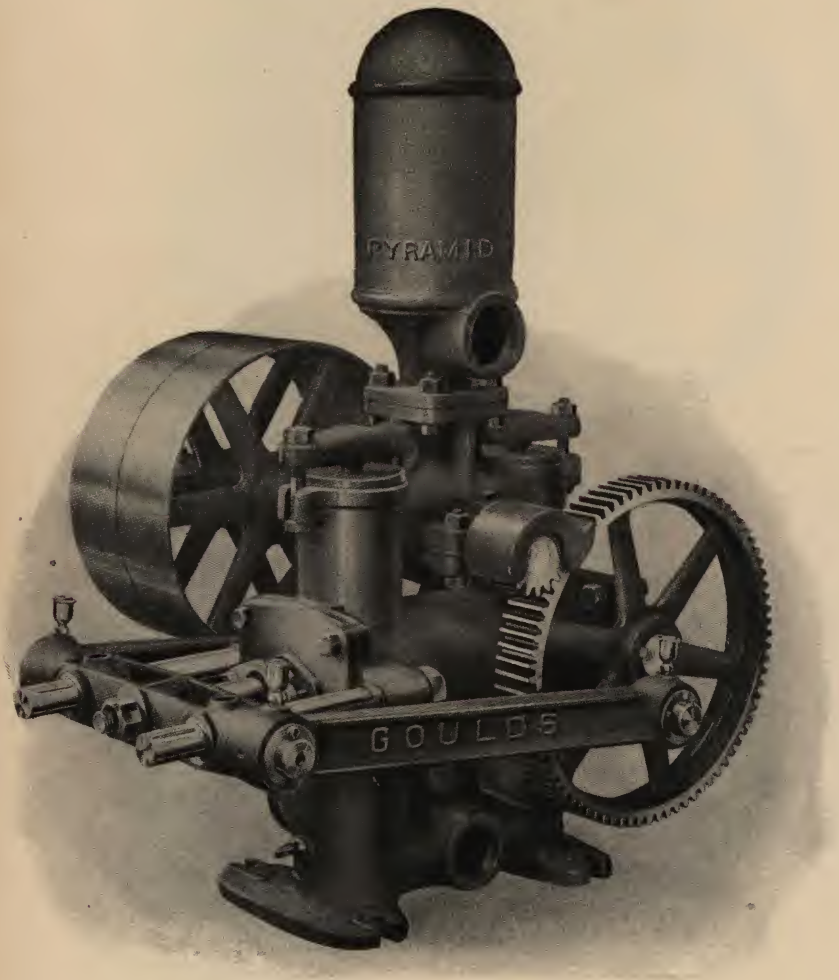


Fig. 1531
Patent Applied For

Capacities ranging from 720 gallons
to 6840 gallons per hour.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

"Pyramid" Double-Acting Piston Pump

SPECIFICATIONS

Figure 1531

Frame Consists of a single iron casting, the base, cylinder, bearings and one cylinder head being cast integrally. By eliminating one cylinder head this construction reduces the amount of packing required. The integral construction also provides rigid alignment of all working parts, reducing wear and giving long life.

Crank Shaft High carbon, open hearth steel, accurately machined to gauge.

Bearings All bearings are lined with the best grade babbitt metal, scraped to an accurate running fit. They are ample in size and provided with extra large oil pockets. The construction is such that the bearings are practically water-jacketed, insuring cool running.

Gearing Both gear and pinion are of hard cast iron, machine cut from the solid.

Crosshead Heavy iron casting with accurately machined bearings for the connecting rods, and babbitted bearings for the crosshead guides. The guides are steel rods, accurately machined and securely attached to the frame.

Connecting Rods Heavy iron castings, and so arranged as to give a straight line thrust from crank pin to crosshead.

Cylinder Best quality hydraulic iron, fitted with a brass lining.

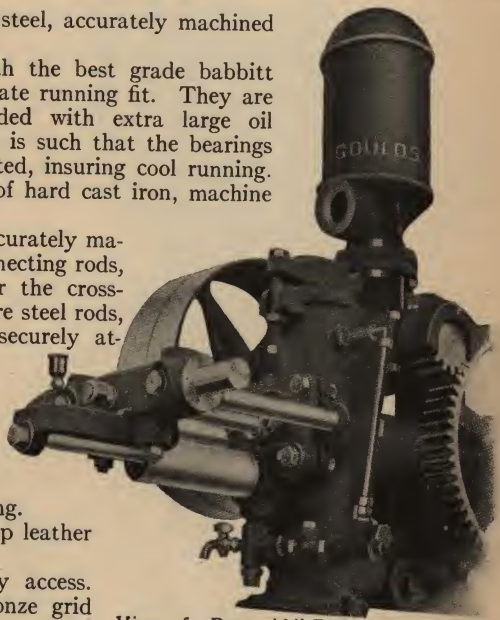
Piston Cast iron, with double crimp leather packing.

Gland Bronze, bolted on, of easy access.

Valves Rubber disc valves on bronze grid seats, of ample area and easy access.

Air Chamber Of ample size and so arranged that the discharge can be taken from either end or side of the pump.

Air Cylinder A special air cylinder can be supplied on the 3x5 and 4x5 pumps when used on pneumatic water supply systems. This eliminates the necessity of installing a separate air pump on such systems.



View of "Pyramid" Pump Fitted with Figure 1567 Air Cylinder

Dimensions, Speeds, Capacities, Prices Goulds "Pyramid" Pumps. Fig. 1531

Piston		Capacity Rev. Crank Shaft Gal.	Usual Speed and Capacity per Minute		For Elevation to Ft.	Size Pipe		Geared	Tight and Loose Pulleys Inches	Weight Lbs.	Cipher	Price
Dia.	Stroke		Rev.	Gal.		Suction Inches	Discharge Inches					
3	5	.293	41	12	175	1½	1½	5 to 1	15 x 2½	280	Zunat	$55.00
4	5	.531	40	21	175	2	2	5 to 1	15 x 3	325	Zunde	65.00
5	5	.823	40	33	175	2½	2½	5 to 1	16 x 4	500	Zunev	85.00
6	6	1.440	40	57	175	3	3	5 to 1	20 x 4	645	Zunhi	100.00
6	12	2.870	40	114	175	4	4	6 to 1	26 x 4	875	Zuniw	175.00

Extra price for Fig. 1567 Air Cylinder for 3x5 or 4x5 inch Pump.

Attachment complete with pipe connections, Cipher (Zywoh), Extra $15 00

Attachment only, no pipe connections, Cipher (Zywry), Extra 10.00

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single-Acting Triplex Plunger Pumps

For 130 Pounds Working Pressure or 300 Feet Elevation

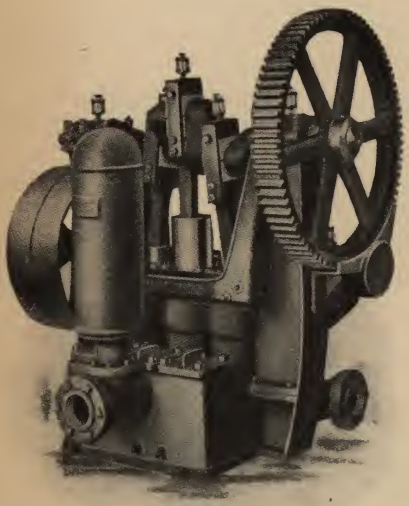


Figure 924

6½" x 8"

Type of 8¼" x 10" and smaller sizes. Capacities ranging from 1,800 gallons to 21,000 gallons per hour.

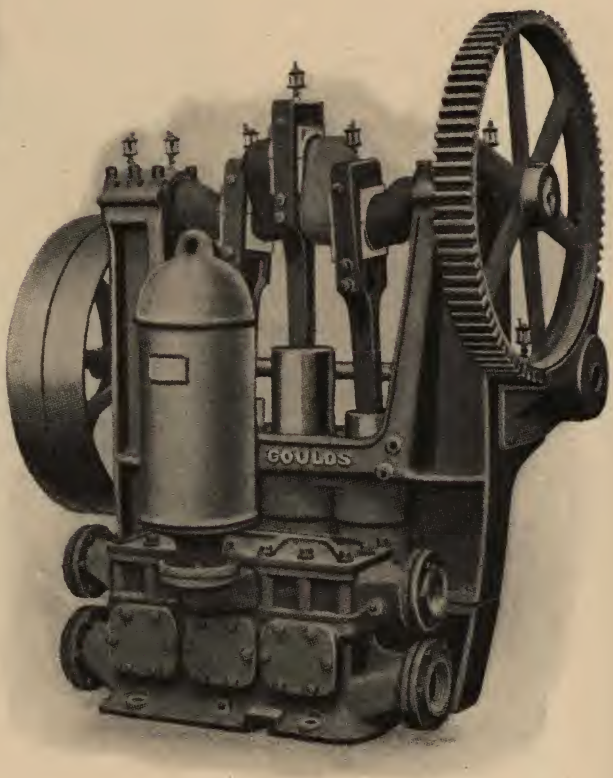


Figure 924

Size 9" x 10"

Capacity 24,000 gallons per hour.

General Water Supply, Municipal Waterworks, Hydraulic Elevators, Pulp Grinders, Railway Water Stations, Etc.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single-Acting Triplex Plunger Pumps

Specifications

Figure 924

Frame	Close grained iron cast in one piece with cylinders, forming exceptionally rigid construction and accurate alignment of all working parts.
Crank Shaft	High carbon open hearth steel, accurately machined to gauge.
Bearings	Crank shaft and pinion shaft bearings are of babbitt metal.
Gearing	Gear and pinion, charcoal iron, machine cut from the solid. A gear guard covers the pinion and adjacent teeth of the gear. Gear ratio 5 to 1 (9 x 10 inch is 6 to 1).
Connecting Rods	Extra long. Strap head and wedge adjustment with bronze boxes at crank end and bronze bushings at plunger end.
Cylinders	Close grained iron cast in one piece with standards.
Plungers	Hard cast iron, accurately machined, ground true and smooth and inside guided.
Glands	Iron, of easy access for adjustment and repacking.
Base and Valve Boxes	Charcoal iron in one casting, of liberal proportion, affording large valve area, direct waterways and easy access.
Valves	Rubber discs on bronze grid seats with cylindrically wound springs. Metal valves as ordered.
Air Chamber	Supplied with pump. Vacuum chamber to order.
Special Construction	Phosphor Bronze Plungers, Lined Cylinders and Glands, Rawhide Pinion, etc., to order.

For Electric and other motive power and methods of control see page 12.

Dimensions and Capacities

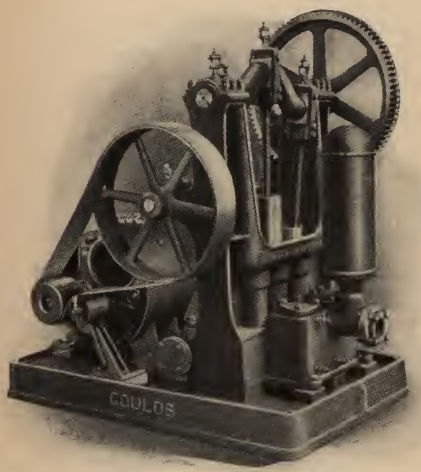
Gallons Displacement per Minute	Size Plungers		Displacement 1 Revolution of Crank Shaft	Rev. per Min.	Horse Power 100-lbs. Pressure	Size Pipe		Tight and Loose Pulley	Cipher
	Diameter Inches	Stroke Inches				Suction Inches	Discharge Inches		
30	4	4	.653 gals.	46	2.6	2	2	20 x 3	Xyxyk
40	4	4	.653 "	62	3.5	2	2	20 x 3	Xyxyk
40	4	6	.978 "	41	3.5	2	2	20 x 3	Xyzaf
50	4	6	.978 "	52	4.3	2	2	20 x 3	Xyzaf
60	4	6	.978 "	62	5.	2	2	20 x 3	Xyzaf
80	5	6	1.531 "	53	6.0	3	3	26 x 4	Xyzbi
100	5	8	2.041 "	49	7.5	3	3	30 x 5	Xyzeg
125	5	8	2.041 "	62	9.1	3	3	30 x 5	Xyzeg
125	5½	8	2.465 "	51	9.4	4	3	30 x 5	Xyzfo
150	5½	8	2.465 "	61	11.	4	3	30 x 5	Xyzfo
150	6½	8	3.440 "	44	11.5	4	4	30 x 6	Xyzih
175	6½	8	3.440 "	51	13.3	4	4	30 x 6	Xyzih
200	6½	8	3.440 "	59	14.4	4	4	30 x 6	Xyzih
200	8	8	5.22 "	39	15.5	6	5	36 x 6	Xyzju
250	8	8	5.22 "	48	18.5	6	5	36 x 6	Xyzju
250	8¼	8	5.56 "	45	18.	6	5	36 x 6	Zunlo
300	8	10	6.52 "	46	21.	6	5	36 x 6	Xyzmy
300	8¼	10	6.94 "	44	21.	6	5	36 x 6	Xyzoj
350	8	10	6.52 "	54	24.	6	5	36 x 6	Xyzmy
350	8¼	10	6.94 "	51	24.	6	5	36 x 6	Xyzoj
400	9	10	8.26 "	49	30.	6	5	42 x 8	Xyzsa

For high suction lifts select pumps to run at slow speeds.
To determine Horse Power for increase or decrease in pressure mulitply Horse Power in table by operating pressure divided by 100.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single-Acting Triplex Plunger Pumps

Forms of Drive and Controls

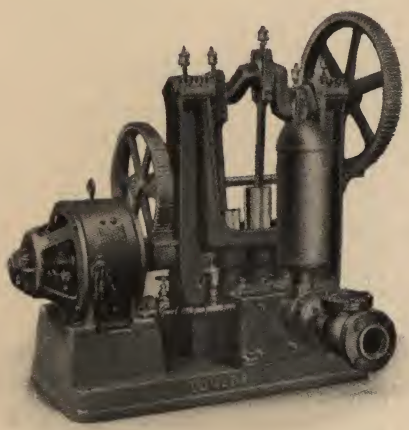


Form A, Figure 924

FORM A (Cipher ZULPI) consists of bedplate, idler, belt and driving pulley for belted connection to electric motor.

FORM N (Cipher ZUMDA) consists of silent chain with sprockets and cast iron bedplate, to order, for connection to electric motor.

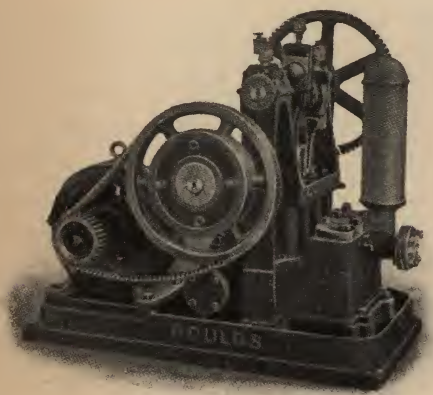
CONTROL K (Cipher ZUMHE) is by-pass arrangement for triplex pumps.



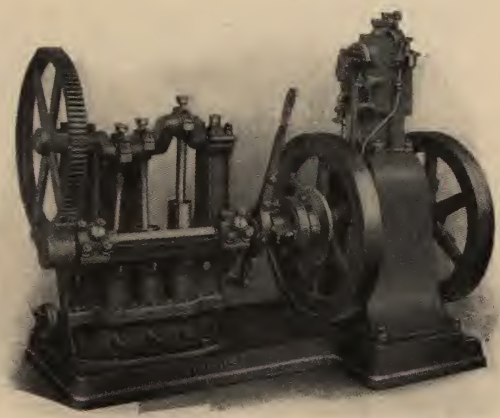
Form C and Control K, Figure 924

FORM C (Cipher ZULUW) consists of intermediate gearing, rawhide motor pinion and bedplate for geared connection to electric motor.

FORM D (Cipher ZULXU) for direct connection with friction cut-off coupling to engine shaft. Furnished with or without cast iron bedplate and cut-off coupling, as ordered. Give engine speed when ordering.



Form N, Figure 924



Form D, Figure 924

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Single Stage, Single Suction

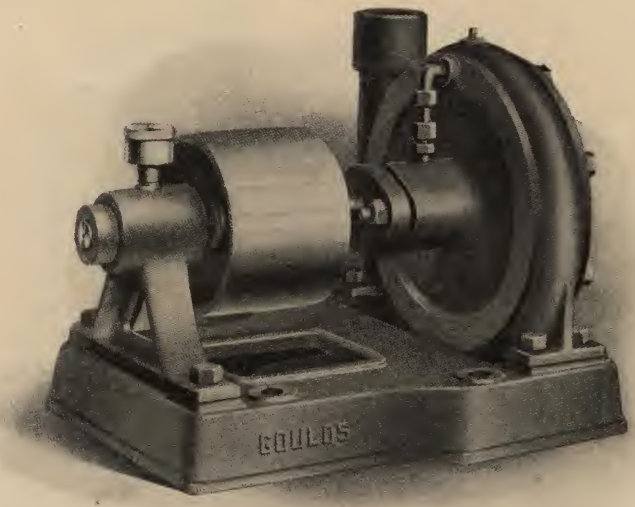


Figure 3000, Number 1

THE utility of the Single Stage, Single Side Suction Centrifugal Pump, for all services against heads up to 100 feet, has placed this type of pump in a position which is ever increasing in importance. It is very simple in construction, consisting fundamentally of a volute casing, shaft, two bearings and an impeller mounted upon the shaft. This, with the driving apparatus, constitutes the complete machine. On account of its low initial cost, few repairs, great durability and high pumping elasticity, it compels instant recognition. The first cost of installation, not only of the pump itself, but of the foundations and necessary building, is always considerably less than for other pumping machinery of the same capacity. These considerations, while they may not necessarily mean that the centrifugal type of pump is the one to install in all cases, warrant a careful investigation of this type before any installation is made.

Adaptability

The Single Stage, Centrifugal Pump, although extremely well adapted for general pumping service, is also well fitted for many special services. On account of the passage of the water through the pump being directly forward, counter currents are prevented. There are no valves to get out of order, and the pump is practically noiseless in operation.

The large open water passages of the Goulds Single Stage, Single Side Suction Centrifugal Pump adapt it particularly well for such work as handling sewage and for stock pumping in pulp and paper mills. As a mine pump, it is well fitted

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Single Stage, Single Suction

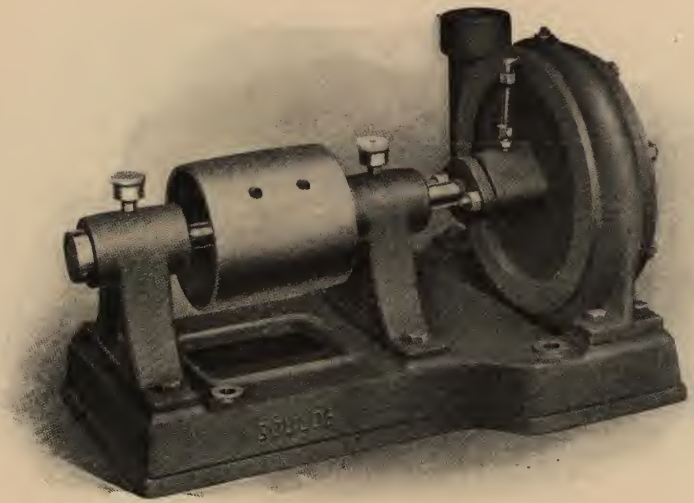


Figure 3000, Number 1½

since the sand and grit nearly always present in mine water, will not injure it. As a pump for irrigation, general water supply and booster service, Goulds Centrifugal Pumps excel on account of the high efficiencies which are obtained.

These are only a few of the services for which the Goulds Centrifugal Pump may be used and the reasons given above are only a few of the many reasons why Goulds Centrifugal Pumps excel in these and many other services.

Construction

Guided by many years of experience in all branches of centrifugal pump work, we have combined in our Single Stage, Single Side Suction Centrifugal Pump all the details which experience has proven must be used to make a thoroughly high class machine.

The impeller is designed so that the total head pumped against and the quantity of fluid handled, can be varied considerably without affecting the mechanical efficiency. It is of the open type which allows the pump to handle muddy, sandy or gritty water. In the manufacture of the pump, great care is taken to minimize the clearances between the side covers and the impeller. This feature is of considerable importance as it assists in making the efficiency of the Goulds Centrifugal higher than that of any other pump of the same type now on the market.

The standard Single Stage, Single Side Suction, Horizontal Shaft Centrifugal Pump, known as Fig. 3000, is arranged for belt drive by means of a pulley. In many cases preference is given to direct connected units and, to meet such cases, this pump is arranged for direct connection to electric motors, steam engines, steam or hydraulic turbines. Direct connected units are provided with rigid or flexible couplings, as conditions demand. This enables the impeller and the pump shaft to be removed without disturbing the prime mover.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Single Stage, Single Suction

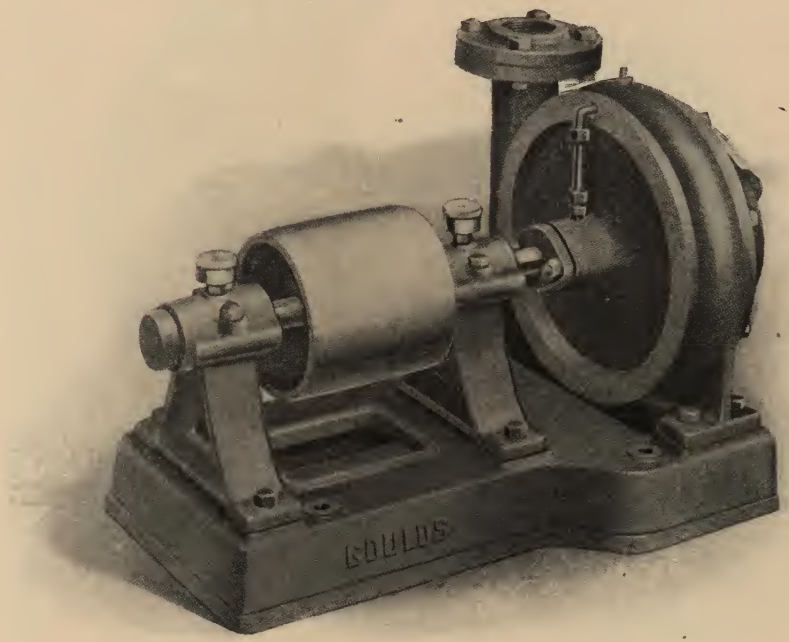


Figure 3000, Number 2

Casing

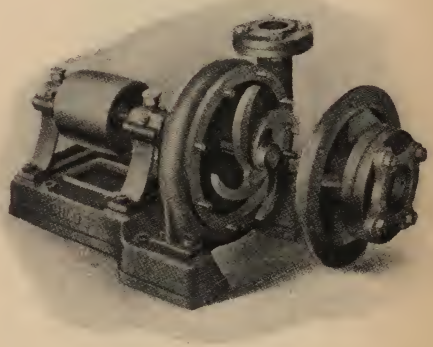
The casing contains the volute water passage which conducts the water to the discharge nozzle, and is made of close grained cast iron of suitable thickness to easily withstand the maximum pressure against which these pumps are designed to operate. It is free from all shrinkage strains as the metal thickness throughout is of uniform section.

Impeller

The impeller is of the open type and is made of close grained cast iron. The vanes are of such shape as will insure the highest possible efficiency under normal conditions. The impeller is accurately machined to a smooth finish, thereby reducing the frictional losses in the pump. It is pressed on the shaft and securely fastenel by means of an accurately fitted taper pin.

Shaft

The shaft is made of open hearth, high carbon steel, accurately machined and of ample size to transmit the maximum power required.



Open View, Figure 3000, Number 2

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Single Stage, Single Suction

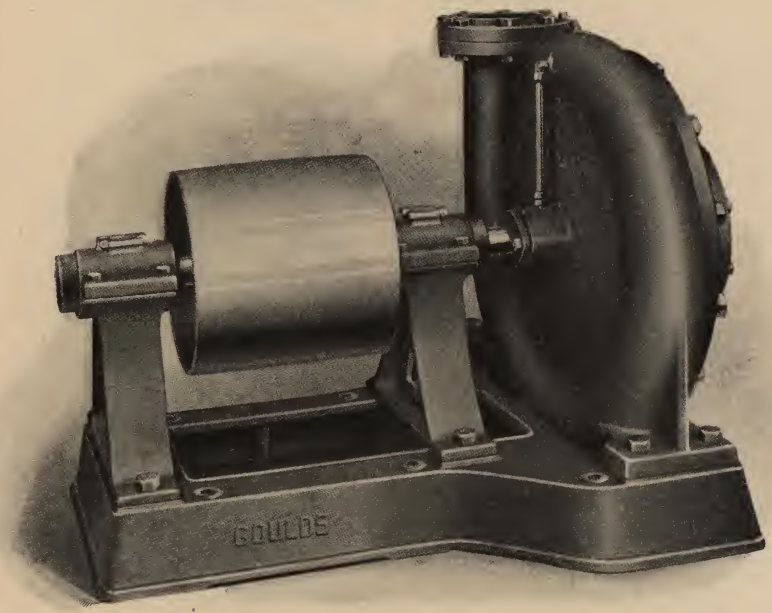


Figure 3000, Number 6

Bearings

Extensive experiments have proven that for small high speed shafts grease is absolutely the best lubricant. For this reason, the small pumps, Nos. 1, 1½, 2, 2½ and 3, are all provided with large compression grease cups. The larger sizes, Nos. 4, 5, 6, 8, 10 and 12, are provided with ring oiling bearings. Large oil reservoirs are provided in the pedestals.

View showing ring oiling bearing and large oil reservoir.

End Thrust

The impeller in the Single Stage, Single Side Suction Centrifugal Pump is designed to minimize the end thrust which must occur in all single suction centrifugals. We have made a large number of experiments and find that the end thrust is practically negligible. As a safeguard, however, we have provided a thrust collar which is securely fastened to the shaft and which bears against a babbitted surface in the bearing.

Stuffing Box

The stuffing box, through which the shaft passes, is provided with a brass water sealing ring. This construction prevents air being drawn into the pump at the stuffing box. Air would destroy the vacuum in the pump and impair suction. The water sealing ring equalizes the pressure, and on this account it is not

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Single Stage, Single Suction

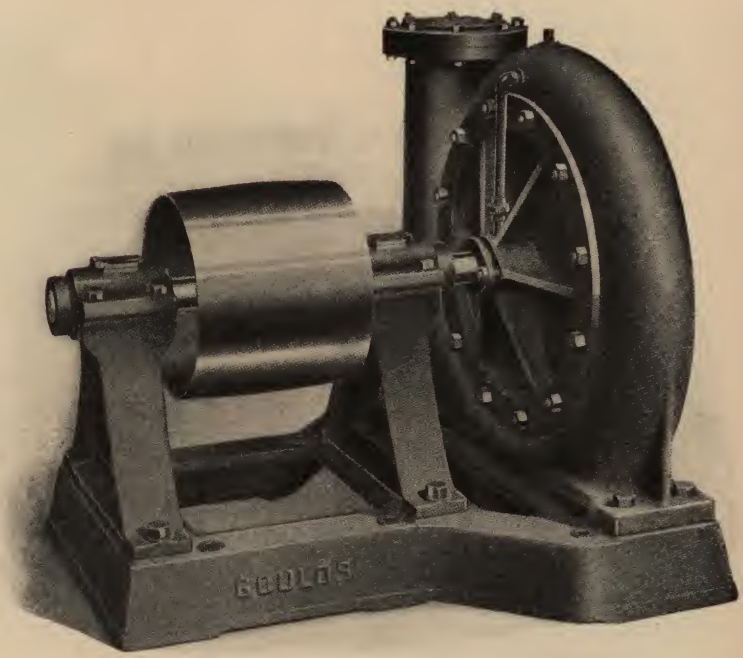


Figure 3000, Number 8

necessary to draw up the gland as tight as it would have to be if the water sealing ring were not used. There is also the additional advantage of insuring that the stuffing box will always run cool.

Priming and Draining

An opening is provided at the highest part of the casing for the purpose of priming the pump, and a suitable opening is also arranged at the bottom of the casing for draining the pump.

Interchangeability

All parts of these pumps are built in quantities to limit gauges and jigs, thereby insuring exact duplication and entire interchangeability.

Shop Erection

The pumps are completely assembled in the shop, working parts properly adjusted and clearances checked.

Test

Before leaving the factory, the pump has its discharge and suction openings blanked and it is subjected to hydraulic pressure considerably in excess of that which it is called upon to withstand in service.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Applications of Power

FIGURE 3003 illustrates the Goulds Single Stage, Single Side Suction, Horizontal Shaft, Centrifugal Pump, arranged on a neat cast iron base plate and direct connected to a high speed gasoline engine. The unit shown consists of a No. 3 Single Stage, Single Side Suction Horizontal Shaft, Centrifugal Pump direct connected to an 8 h.p. 2-cylinder, 2-cycle, Vertical Marine motor.

The speed of the engine can be instantly changed while running and consequently the pump offers a large variation in capacity and elevation. This feature makes the unit particularly useful for contractors and others in pumping out excavations, foundations, etc., where a portable outfit is required.

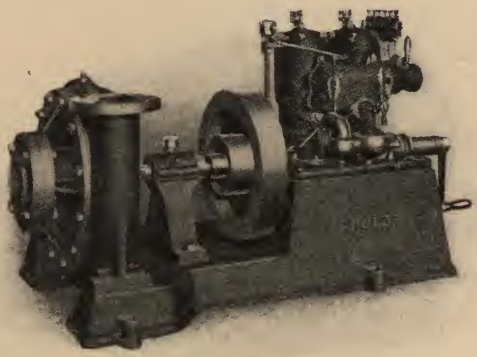


Figure 3003 Connected to Gasoline Engine

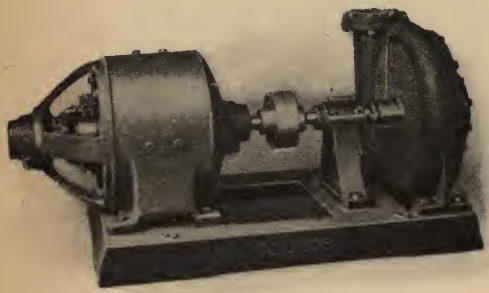


Figure 3004 Connected to Electric Motor

Figure 3004 illustrates the Goulds Single Stage Single Side Suction Horizontal Shaft, Centrifugal Pump direct connected to an electric motor. The pump and the motor are mounted upon an extended cast iron base plate, making the unit practically self-contained. The pump and the motor are direct connected by means of a suitable coupling of the flexible or rigid type, depending upon the conditions of service.

Figure 3005 illustrates the Goulds Single Stage, Single Side Suction, Horizontal Shaft, Centrifugal Pump with tight and loose pulleys, and with the discharge nozzle increased to the same size as the suction nozzle.

The Pump with regular nozzles and with tight and loose pulleys, is designated as Figure 3011.

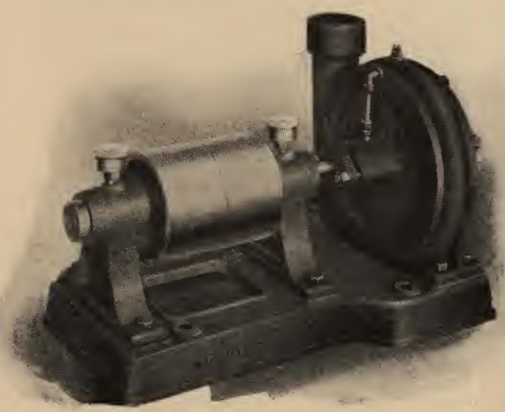


Figure 3005, No. 1½

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single Stage, Single Suction

Figure 3000

Table of revolutions per minute and horse power required when pumping against total heads of 10 to 100 feet at rated capacity

Pump Number.		1	1½	2	2½	3	4	5	6	8	10	12
Capacity gals. per minute.		30	70	120	200	270	470	550	1050	2000	3000	4200
10 Ft.	R.P.M.	1310	1100	930	845	615	455	435	430	310	305	300
	B.H.P.	.25	.59	.87	1.4	1.7	3.0	4.2	5.3	9.5	14	19
20 Ft.	R.P.M.	1590	1150	1145	880	705	520	495	460	380	365	350
	B.H.P.	.39	.89	1.6	2.7	3.1	5.2	7.9	11	17	24	34
30 Ft.	R.P.M.	1840	1315	1210	960	790	580	560	525	445	420	400
	B.H.P.	.58	1.1	2.2	3.3	4.1	6.7	11	14	24	35	47
40 Ft.	R.P.M.	2050	1465	1310	1040	875	645	610	580	500	470	445
	B.H.P.	.79	1.5	2.6	4.1	5.2	8.8	14	18	32	46	62
50 Ft.	R.P.M.	2260	1615	1405	1130	945	700	665	625	550	520	485
	B.H.P.	1.0	1.9	3.2	5.1	6.3	11	17	22	41	59	79
60 Ft.	R.P.M.	2450	1755	1510	1210	1020	750	710	675	595	560	525
	B.H.P.	1.2	2.3	3.8	6.2	7.9	13	20	27	50	72	96
70 Ft.	R.P.M.	2600	1875	1615	1295	1090	805	760	720	640	600	560
	B.H.P.	1.5	2.8	4.5	7.2	9.2	15	24	31	59	85	114
80 Ft.	R.P.M.	2770	1995	1705	1370	1150	850	800	755	680	635	595
	B.H.P.	1.8	3.4	5.3	8.4	11	18	28	37	68	99	135
90 Ft.	R.P.M.	2930	2110	1780	1440	1215	900	845	800	720	670	625
	B.H.P.	2.0	3.9	6.1	9.7	12	21	32	41	78	114	154
100 Ft.	R.P.M.	3070	2220	1875	1510	1270	940	890	835	755	705	660
	B.H.P.	2.3	4.3	6.9	11	14	24	36	47	87	126	174

Table of capacity in gallons per minute, revolutions per minute and horse power required for various heads at maximum efficiency of pumps

Pump Number.		1	1½	2	2½	3	4	5	6	8	10	12
10 Ft.	G.P.M.	18	35	48	86	118	216	343	440	1000	1500	2100
	R.P.M.	1060	730	615	500	420	315	300	275	250	235	220
	B.H.P.	.11	.18	.25	.44	.56	1.0	1.5	1.9	4.0	5.8	7.8
20 Ft.	G.P.M.	25	49	68	122	169	305	480	625	1420	2100	3000
	R.P.M.	1500	1035	870	710	600	445	420	390	355	330	315
	B.H.P.	.31	.52	.72	1.2	1.6	2.8	4.3	5.3	11	16	22
30 Ft.	G.P.M.	30	60	84	150	205	370	590	770	1740	2580	3700
	R.P.M.	1840	1265	1065	870	730	540	515	480	430	405	385
	B.H.P.	.58	.96	1.3	2.3	2.9	5.1	7.8	9.7	21	30	41
40 Ft.	G.P.M.	35	70	97	172	237	428	680	880	2000	3000	4200
	R.P.M.	2120	1465	1230	1000	845	625	595	550	500	470	445
	B.H.P.	.89	1.5	2.0	3.5	4.5	7.9	12	15	32	46	62
50 Ft.	G.P.M.	39	78	108	200	270	470	750	985	2240	3350	4800
	R.P.M.	2370	1635	1370	1130	945	700	660	615	560	525	500
	B.H.P.	1.2	2.1	2.8	5.1	6.3	11	17	21	45	64	89
60 Ft.	G.P.M.	43	85	120	212	290	528	830	1050	2460	3670	5150
	R.P.M.	2600	1790	1510	1230	1030	770	725	675	615	575	545
	B.H.P.	1.6	2.7	3.8	6.5	8.3	15	22	27	60	85	115
70 Ft.	G.P.M.	47	92	128	230	314	569	900	1170	2640	3960	5700
	R.P.M.	2810	1935	1625	1330	1115	830	785	730	660	620	590
	B.H.P.	2.1	3.4	4.7	8.2	10	18	28	35	75	107	148
80 Ft.	G.P.M.	50	99	137	245	336	607	960	1250	2840	4250	6050
	R.P.M.	3000	2070	1740	1420	1195	885	840	780	710	665	630
	B.H.P.	2.5	4.2	5.8	10	13	22	34	42	92	131	180
90 Ft.	G.P.M.	53	104	145	258	356	645	1000	1330	3000	4500	6400
	R.P.M.	3180	2190	1840	1500	1265	940	880	830	750	705	665
	B.H.P.	3.0	5.0	6.9	12	15	27	40	50	109	156	214
100 Ft.	G.P.M.	56	110	152	274	375	679	1070	1400	3160	4720	6750
	R.P.M.	3350	2310	1940	1590	1335	990	935	875	790	740	700
	B.H.P.	3.5	5.9	8.0	14	18	31	47	59	128	182	250

G. P. M. = Gallons per minute; B. H. P. = Brake Horse power; R. P. M. = Revolutions per minute.
The speeds given above are for Standard Impellers. If necessary 25% increase will be allowed.

Note.—In using these tables for Figs. 3010 and 3005, be sure to use "Pump Number"—not "size of Discharge Nozzle," as these numbers do not correspond on these Figure Numbers as they do on the regular 3000 and 3011 construction.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Centrifugal Pumps

Table showing loss of head in feet due to friction, in various size, new smooth, straight cast iron pipes, per 100 feet, when discharging the following quantities of water.

Gals. per Min.	1 inch		1¼ inches		1½ inches		2 inches		2½ inches		3 inches		4 inches		5 inches		6 inches		8 inches		10 inches		12 inches	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
5	1.86	2.32	1.07	0.60	0.79	0.28	0.49	0.08	0.24	0.06														
10	3.72	8.40	2.14	2.18	1.57	1.02	1.02	0.36	0.65	0.12	0.45	0.05												
15	6.13	18.90	3.92	4.65	2.72	2.25	1.53	0.81	0.98	0.25	0.68	0.11												
20	7.44	30.10	4.29	7.90	3.15	3.70	2.04	1.29	1.31	0.43	0.91	0.18												
25	9.30	45.50	5.36	11.90	4.56	5.60	2.60	1.96	1.63	0.66	1.13	0.27												
30	11.15	64.00	6.43	16.90	4.72	7.80	3.06	2.73	1.96	0.92	1.36	0.38												
35	13.02	85.00	7.51	22.30	5.51	10.30	3.57	3.66	2.29	1.23	1.59	0.51												
40	14.88	109.00	8.58	28.50	6.30	13.30	4.05	4.68	2.62	1.57	1.82	0.65	1.02	0.16										
45			9.68	35.20	7.08	16.60	4.60	5.80	2.95	1.97	2.02	0.80	1.17	0.20										
50			10.72	43.20	7.87	20.20	5.11	7.10	3.30	2.38	2.27	0.98	1.28	0.24										
70					11.02	37.60	7.15	13.20	4.60	4.42	3.18	1.83	1.79	0.45	1.14	0.15								
100					15.74	73.00	10.20	25.60	6.54	8.60	4.54	3.52	2.55	0.88	1.63	0.29	1.14	0.10						
120							12.25	36.00	7.84	12.00	5.45	4.97	3.06	1.22	1.96	0.41	1.42	0.18						
150							15.30	54.00	9.80	18.72	6.80	7.72	3.84	1.82	2.45	0.63	1.71	0.23						
175									11.43	23.70	7.92	9.75	4.45	2.40	2.86	0.84	2.00	0.34						
200									13.07	30.90	9.08	12.80	5.11	3.12	3.27	1.06	2.28	0.44						
250											11.28	19.70	6.40	4.80	4.08	1.60	2.80	0.66	1.60	0.16				
270											12.45	22.70	6.90	5.50	4.42	1.86	3.03	0.81	1.70	0.18				
300											13.62	27 10	7.66	6.70	4.90	2.25	3.40	0.92	1.90	0.26				
350													8.90	8.80	5.72	2.99	3.98	1.21	2.20	0.29				
400													10.20	11.30	6.54	3.81	4.54	1.58	2.60	0.40				
450													11.50	14.10	7.35	4.75	5.12	1.96	2.92	0.46	1.80	0.15		
470													12.16	16.00	7.78	5.30	5.49	2.23	3.07	0.55	1.92	0.17		
500													12.77	17.20	8.17	5 80	5.60	2.33	3.20	0.58	2.00	0.19	1.40	0.08
750															12.26	12.30	8.40	4.87	4.80	1.24	3.00	0.39	2.10	0.17
1050																	12.57	10.30	7.04	2.51	4.40	0.83	3.08	0.34
1250																	14.10	13.00	8.00	3.18	5.00	1.03	3.50	0.43
1500																			9.60	4.48	6.10	1.49	4.20	0.61
2000																			12.70	7.65	8.10	2.50	5.60	1.02
2500																					10.10	3.81	7.00	1.56
3000																					12.10	5.30	8.40	2.42
3500																					14.10	7.20	9.80	2.80
4000																							11.35	3.80
4200																							11.93	4.50
4500																							12.78	4.82
5000																							14.20	5.82

Table showing loss of head in feet, due to friction in various sizes of smooth 90° elbows.

Gals per Min	1 inch		1¼ inches		1½ inches		2 inches		2½ inches		3 inches		4 inches		5 inches		6 inches		8 inches		10 inches		12 inches	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
5	2.04	0.06	1.30	0.14																				
10	4.08	0.22	2.60	0.21																				
15	6.12	0.49	3.90	0.29	2.73	0.09																		
20	8.16	0.87	5.20	0.52	3.64	0.16																		
25	10.20	1.35	6.50	0.80	4.55	0.23	2.60	0.09																
30	12.24	1.95	7.80	1.15	5.46	0.36	3.06	0.13																
35	14 28	2.65	9.10	1.60	6.37	0.50	3.57	0.18	2.29	0.09														
40	16.32	3.46	10.40	2.05	7.28	0.64	4.05	0.23	2.62	0.11														
45			11.70	2.70	8.19	0.81	4.60	0.29	2.95	0.14	2.02	0.06												
50					9.10	0.99	5.11	0.35	3.30	0.18	2.27	0.08												
70					12.74	1.98	7.15	0.70	4.60	0.34	3.18	0.19	1.79	0.05										
100							10.20	1.41	6.54	0.74	4.54	0.29	2.55	0.10										
120							12.25	2.24	7.84	1.17	5.45	0.05	3.06	0.15	1.96	0.06								
150							15.30	3.20	9.80	1.58	6.80	0.66	3.84	0.22	2.45	0.09								
175									11.43	2.16	7.92	0.90	4.45	0.30	2.86	0.12	2.00	0.06						
200									13.07	2.96	9.08	1.18	5.11	0.40	3.27	0.16	2.28	0.07						
250											11.28	1.84	6.40	0.62	4.08	0.25	2.80	0.12	1.60	0.04				
270											12.45	2.35	6.90	0.70	4.42	0.27	3.03	0.14	1.70	0.04				
300											13.62	2.63	7.66	0.89	4.90	0.36	3.40	0.18	1.90	0.06				
350													8.90	1.24	5.72	0.50	3.98	0.24	2.20	0.09				
400													10.20	1.59	6.54	0.63	4.54	0.29	2.60	0.10				
450													11.50	2.01	7.35	0.81	5.12	0.39	2.92	0.13	1.80	0.05		
470													12.16	2.26	7.78	0.90	5.49	0.46	3.07	0.14	1.92	0.06		
500													12.77	2.47	8.17	1.01	5.60	0.48	3.20	0.16	2.00	0.06	1.40	0.04
750															12.26	2.24	8.40	1.09	4.80	0.36	3.00	0.15	2.10	0.07
1050																	12.57	2.41	7.04	0.76	4.40	0.29	3.08	0.14
1250																	14.10	3.02	8.00	1.00	5.00	0.40	3.50	0.20
1500																			9.60	1.44	6.10	0.58	4.20	0.29
2000																			12.70	2.44	8.10	1.01	5.60	0.47
2500																			15.90	3.68	10.10	1.57	7.00	0.75
3000																					12.10	2.25	8.40	1.08
3500																					14.10	3.05	9.80	1.47
4000																							11.35	1.92
4200																							11.93	2.18
4500																							12.78	2.43
5000																							14.20	3.01

Table shows losses for 1 elbow, and based on Weisbach's formula for short radius bends.
When pipe or elbow is slightly rough add 15%. When very rough add 30%.
Vel.—Velocity in pipe and elbows in feet per second. Fric.—Friction head in feet.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Differential Power Working Head

For Operating Single and Double Acting
Deep Well Cylinders

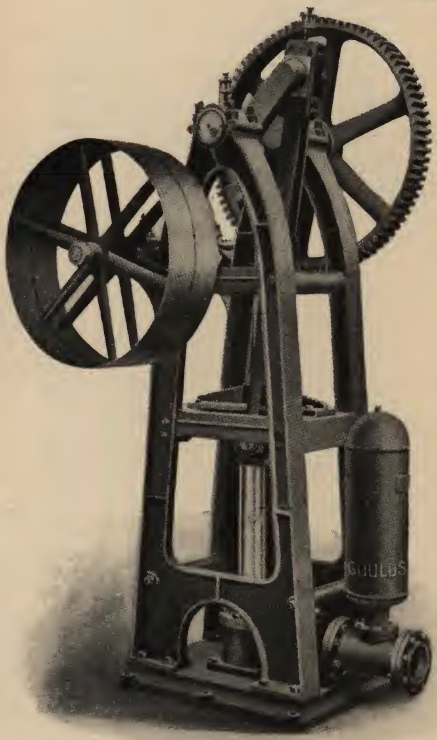


Figure 971
16", and A and B, 24" Stroke
For medium capacities in wells to depth of 450 feet.

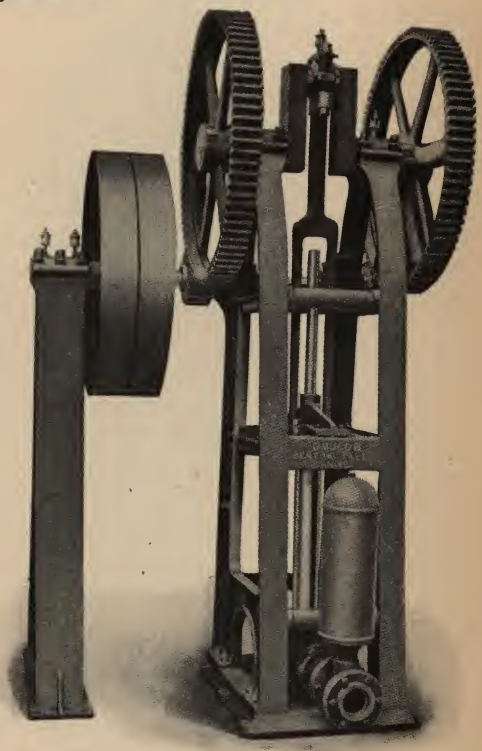


Figure 971
C, 24" Stroke
For larger capacities and in wells to depth of 400 feet.

Specifications

Figure 971

Frame	Consists of two cast iron standards bolted to the base, strongly braced and fastened together with center guide and tie pieces, forming a very rigid construction.
Crank Shaft	High carbon open hearth steel, accurately machined to gauge.
Bearings	Crank and pinion shaft bearings, babbitt metal.
Gearing	Charcoal iron, machine cut from the solid. Size 24C is double geared.
Connecting Rod	Sizes 16-in. 24A and 24B, strap head with wedge adjustment and bronze box at crank end, and adjustable babbitted boxes at cross-head end. Size 24C fitted with adjustable bronze boxes, marine type, at both ends.
Differential Plunger	Cast iron, working through an outside packed Stuffing Box with bolted gland.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Differential Power Working Head

Figure 971. Single-Acting Working Head, Sizes, Etc.

Stroke Inches	Maximum Size of Pipe: Suction Inches	Maximum Size of Pipe: Discharge Inches	Geared	Pulleys Tight and Loose Inches	Approximate Weight in Lbs.	Cipher	Price
16	8	4	5 to 1	30 x 6	2900	Xylcy	$450.00
24A	9	5	5 to 1	36 x 6	3500	Xyles	500.00
24B	9	5	5 to 1	36 x 8	3800	Xylha	600.00
24C	10	5	5 to 1	48 x 8	5500	Xylit	750.00

Figure 904. Deep Well Cylinder

Gallons Displacement per Minute	Fig. 904 Diameter and Stroke Inches	Capacity per Revolution of Crank Shaft	Rev. per Min.	*Depth of Well in Which Fig. 971 Will Operate Fig. 904 Cylinder: 16 Inch	24-Inch A	24-Inch B	24-Inch C	Approx. Weight in Lbs.	Cipher	Price All Brass
17	3½ x 16	.57 gals.	30	450 feet	.....	.....	.....	38	Xinxo	$48.00
21	3¾ x 24	.86 "	25	.....	450 feet	.....	.....	43	Xipar	52.00
22	3⅜ x 16	.76 "	30	400 "	.....	.....	.....	58	Xipov	70.00
28	3¾ x 24	1.14 "	25	.....	400 "	.....	.....	64	Xipto	75.00
29	4¼ x 16	.98 "	30	350 "	.....	.....	.....	101	Xiret	90.00
36	4¼ x 24	1.47 "	25	.....	350 "	430 feet	.....	107	Xiriv	95.00
36	4⅜ x 16	1.22 "	30	300 "	.....	.....	.....	129	Xirxy	127.50
46	4¾ x 24	1.84 "	25	.....	300 "	375 "	.....	135	Xisat	135.00
53	5⅜ x 16	1.78 "	30	200 "	.....	.....	.....	176	Xislo	180.00
67	5¾ x 24	2.69 "	25	.....	200 "	250 "	400 feet	182	Xisox	195.00
74	6⅜ x 16	2.48 "	30	150 "	.....	.....	.....	205	Xisuz	280.00
93	6¾ x 24	2.72 "	25	.....	150 "	200 "	330 "	212	Xisyb	300.00
98	7⅜ x 16	3.26 "	30	125 "	.....	.....	.....	235	Xitdi	425.00
122	7¾ x 24	4.90 "	25	.....	125 "	160 "	250 "	260	Xitew	450.00
125	8⅜ x 16	4.16 "	30	100 "	.....	.....	.....	476	Xitlu	685.00
156	8¾ x 24	6.25 "	25	.....	100 "	125 "	200 "	498	Xitoz	725.00

* From surface of water in well to point of deliver y. For size of well pipe, rods, etc., for Fig. 904 see pages 11 and 12.

Figure 971. Ratings with Double-Acting Cylinders

Gallons per Minute	Diameter and Stroke	Gallons Capacity per Rev.	Rev. per Min.	Depth of Well in Which 971 Will Operate Cylinder: 16-Inch	24-Inch A	24-Inch B	24-Inch C	Price of Double-Acting Cylinder	*Price of Guide Couplings
14.4	2¼ x 16	.48	30	.....	.....	.....	.....	$50.00	$1.25
18.	2¼ x 24	.72	25	.....	.....	.....	.....	50.00	1.25
22.2	2⅜ x 16	.74	30	375 feet	.....	.....	.....	75.00	1.80
27.75	2⅜ x 24	1.11	25	.....	375 feet	.....	.....	75.00	1.80
31.5	3½ x 16	1.05	30	340 "	.....	.....	.....	100.00	2.25
39.5	3¼ x 24	1.58	25	.....	340 "	475 feet	.....	100.00	2.25
43.2	3⅜ x 16	1.44	30	300 "	.....	.....	.....	125.00	3.00
54.	3¾ x 24	2.16	25	.....	300 "	355 "	390 feet	125.00	3.00
56.4	4½ x 16	1.88	30	260 "	.....	.....	.....	150.00	3.50
70.5	4¼ x 24	2.82	25	.....	260 "	320 "	375 "	150.00	3.50
69.3	4⅜ x 16	2.31	30	225 "	.....	.....	.....	225.00	4.10
86.5	4¾ x 24	3.46	25	.....	225 "	380 "	355 "	225.00	4.10
99.	5½ x 16	3.30	30	150 "	.....	.....	.....	275.00	5.00
123.7	5¾ x 24	4.95	25	.....	150 "	185 "	300 "	275.00	5.00
129.	6½ x 16	4.30	30	120 "	.....	.....	.....	375.00	6.00
161.2	6½ x 24	6.45	25	.....	120 "	160 "	240 "	375.00	6.00
170.1	7½ x 16	5.67	30	100 "	.....	.....	.....	575.00	6.85
112.5	7½ x 24	8.50	25	.....	100 "	125 "	190 "	575.00	6.85
213.3	8½ x 16	7.11	30	80 "	.....	.....	.....	675.00	7.50
266.6	8½ x 24	10.66	25	.....	80 "	100 "	150 "	675.00	7.50

* With these cylinders the pump rods must be cut in 10 ft. lengths and connected with guide couplings.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Differential Power Working Head

For Operating Single and Double-Acting Deep Well Cylinders

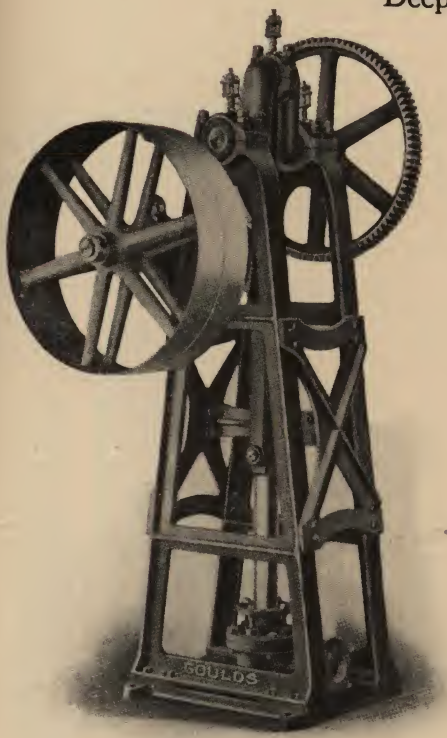


Figure 1030

16″ Stroke

For wells to depth of 360 feet.

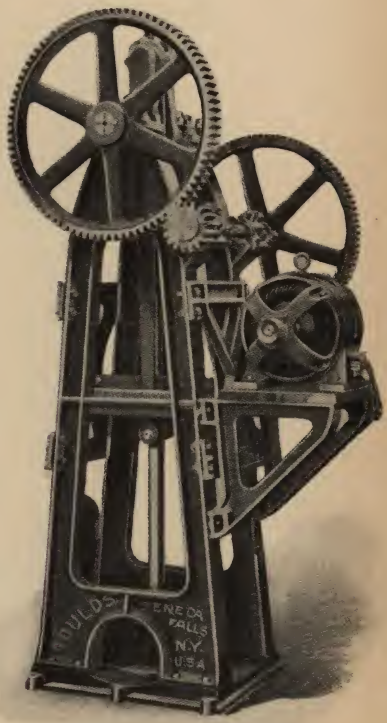


Figure 1030

24″ Stroke with Direct Connected Motor

For wells to depth of 360 feet.

Specifications

Figure 1030

Frame	Consists of two cast iron standards bolted to the base, securely braced and fastened together with center guide and cross piece, forming a very rigid construction.
Crank Shaft	High carbon open hearth steel, accurately machined to gauge.
Bearings	Crank and pinion shaft bearings are babbitt metal.
Gearing.	Gear and pinion charcoal iron, machine cut from the solid.
Connecting Rod	Fitted with adjustable box, babbitted at crank end and with bronze bushing at crosshead end.
Differential Plunger	Cast iron, working through an outside packed Stuffing Box with bolted gland.
Air Chamber	Furnished, if ordered, price extra.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Differential Power Working Head

Figure 1030. Single-Acting Working Head

Stroke Inches	Maximum Size of Pipe		Geared	Pulleys Tight and Loose Inches	Approximate Weight in Pounds	Without Air Chamber		With Air Chamber	
	Suction Inches	Discharge Inches				Cipher	*Price For Belt Drive	Cipher	*Price For Belt Drive
10	6	3	4 to 1	20 x 4	700	Xykuv	$150.00	Znnza	$160.00
16	6	3	5 to 1	26 x 4	1000	Xykyw	200.00	Zupdi	210.00
24	6	3	5 to 1	30 x 5	2450	Xylar	350.00	Zupew	360.00

*Prices for direct connected outfits will be given on application.

Figure 904. Brass Deep Well Cylinders

Gallons Displacement per Minute	Fig. 904 Diameter and Stroke .Inches	*Fig. 1030 Will Operate in Well Feet	Capacity 1 Revolution of Crank Shaft	Rev. per Min.	Top and Bottom Connecting Pipe Inches	Maximum Outside Diameter Inches	Square Wood Sucker Rod Inches	Approx. Weight in Lbs.	Cipher	Price All Brass
8.9	2¾ x 10	360	.257 gals.	35	3	3⅞	1½	19	Ximyv	$34.00
12.3	2¾ x 16	360	.411 "	30	3	3⅞	1½	22	Xiner	36.00
12.5	3¼ x 10	260	.359 "	35	3½	4½	2	35	Xinpe	45.00
17.0	3¼ x 16	260	.574 "	30	3½	4½	2	38	Xinxo	48.00
21.6	3¼ x 24	330	.862 "	25	3½	4½	2	43	Xipar	52.00
16.7	3¾ x 10	200	.478 "	35	4	5⅛	2¼	53	Xipha	67.50
22.9	3¾ x 16	200	.764 "	30	4	5⅛	2¼	58	Xipov	70.00
28 5	3¾ x 24	270	1.140 "	25	4	5⅛	2¼	64	Xipto	75.00
21.5	4¼ x 10	160	.614 "	35	4½	5¾	2½	99	Xipyx	87.50
29.4	4¼ x 16	160	.982 "	30	4½	5¾	2½	101	Xiret	90.00
36.7	4¼ x 24	225	1.47 "	25	4½	5¾	2½	107	Xiriv	95.00
26.8	4¾ x 10	130	.767 "	35	5	6¼	3	122	Xirpo	120.00
36.8	4¾ x 16	130	1.227 "	30	5	6¼	3	129	Xirxy	127.50
46.0	4¾ x 24	190	1.84 "	25	5	6¼	3	135	Xisat	135.00
39.2	5¾ x 10	90	1.12 "	35	6	7¼	3½	170	Xishi	172.50
53.4	5¾ x 16	90	1.78 "	30	6	7¼	3½	176	Xislo	180.00
67.25	5¾ x 24	130	2.69 "	25	6	7¼	3½	182	Xisox	195.00

* From surface of water in well to point of delivery.

Figure 1030. Ratings with Double-Acting Cylinders

Gallons per Minute	Diameter and Stroke Inches	Gallons Capacity per Rev'lut'n	Rev'lut'n per Minute	Fig. 1030 Will Operate in Well Feet	Price of Double-Acting Cylinders	*Price of Guide Couplings	Gallons per Minute	Diameter and Stroke Inches	Gallons Capacity per Rev'lut'n	Rev'lut'n per Minute	Fig. 1031 Will Operate in Well Feet	Price of Double-Acting Cylinder	Price of Guide Couplings
10.5	2¼ x 10	.30	35	400	$50.00	$1.25	50.5	4¾ x 10	1.44	35	95	$225.00	$4.10
14.4	2¼ x 16	.48	30	400	50.00	1.25	69.3	4¾ x 16	2.31	30	95	225.00	4.10
18.	2¼ x 24	.72	25	410	50.00	1.25	86.5	4¾ x 24	3.46	25	140	225.00	4.10
16.2	2¾ x 10	.463	35	270	75.00	1.80	72.	5¾ x 10	2.06	35	65	275.00	5.00
22.2	2¾ x 16	.74	30	270	75.00	1.80	99.	5¾ x 16	3.30	30	65	275.00	5.00
27.75	2¾ x 24	1.11	25	280	75.00	1.80	123.7	5¾ x 24	4.95	25	95	275.00	5.00
23.	3¼ x 10	.66	35	195	100.00	2.25	97.7	6½ x 10	2.79	35	50	375.00	6.00
31.5	3¼ x 16	1.05	30	195	100.00	2.25	129.	6½ x 16	4.30	30	50	375.00	6.00
39.5	3¼ x 24	1.58	25	245	100.00	2.25	161.2	6½ x 24	6.45	25	75	375.00	6.00
31.4	3¾ x 10	.90	35	150	125.00	3.00	124.	7½ x 10	3.54	35	40	575.00	6.85
43.2	3¾ x 16	1.44	30	150	125.00	3.00	170.1	7½ x 16	5.67	30	40	575.00	6 85
54.	3¾ x 24	2.16	25	200	125.00	3.00	212.5	7½ x 24	8.50	25	60	575.00	6.85
41.	4¼ x 10	1.17	35	120	150.00	3.50	155.5	8½ x 10	4.44	35	30	675.00	7.50
56.4	4¼ x 16	1.88	30	120	150.00	3.50	213.3	8½ x 16	7.11	30	30	675.00	7.50
70.5	4¼ x 24	2.82	25	165	150.00	3.50	266.6	8½ x 24	10.66	25	45	675.00	7.50

*With these cylinders the pump rod must be cut in 10 ft. lengths and connected with guide couplings.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

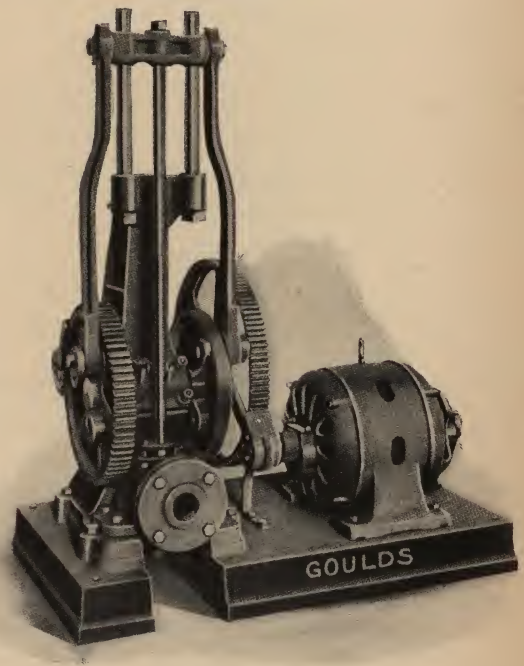
Single-Acting Power Working Head

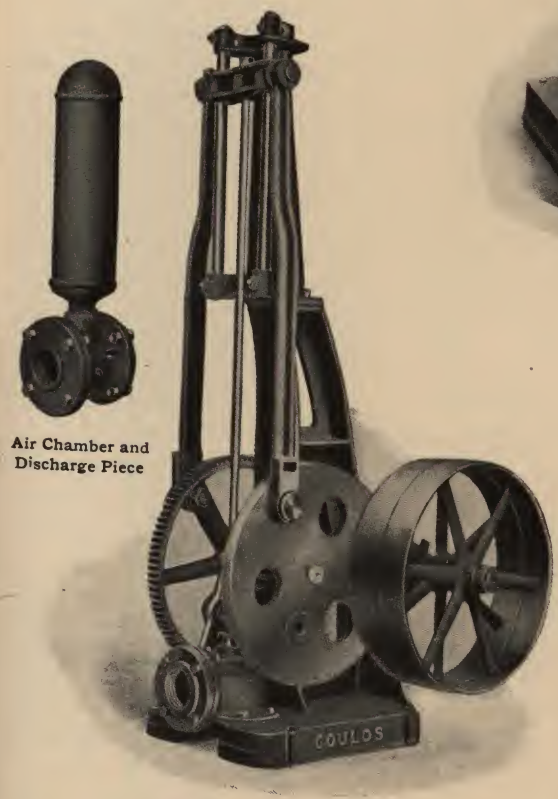
For Operating Single-Acting Deep Well Cylinders

Figure 1454

10″ Stroke with Direct Connected Motor

For medium capacities in wells to a depth of 275 feet.





Air Chamber and Discharge Piece

Figure 1454

20″ Stroke

For large capacities in wells to depth of 300 feet.

NOTE: The data in this bulletin is given for the convenience of customers, and every effort is made to have it correct and up-to-date. It is subject to change without notice, however, and this company cannot be held responsible for typographical errors or omissions.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single-Acting Power Working Head

Specifications

Figure 1454

THIS NEW DEEP WELL WORKING HEAD is very compact and exceptionally strong. It was designed to meet a demand for a low priced machine, powerful enough to operate on deep artesian or bored wells. The frame and base are in one piece. A strong T casting which supports the guide rods, is bolted to the top of the frame, making a very rigid construction. Where the foundation may not be very solid, guy wires may be secured to the top of the head (three holes being provided for that purpose); this will prevent nearly all vibration when the head is in operation.

The stroke is adjustable. If it is desired at any time to force the water to a higher elevation the stroke can be easily shortened by changing the wrist pins in the driving wheels.

The main and pinion bearings are babbitted. They are split to permit of easy removal of the shafts, and are provided with caps and oil boxes.

The position of the gears and plunger rod is such that the connecting rods move almost vertically on the up stroke, thereby lifting the water with the least expenditure of power.

The plunger rod and guide rods are polished steel. The gears are machine cut from the solid and are protected by a guard.

The stuffing box gland is brass and easily accessible for repairs.

By detaching the connecting rods and removing the stuffing box cap, a 4¾-in. plunger can be drawn up through the 10-in. head and a 5¾-in. plunger through the 20-in. head, without disturbing pipe connections.

An Air Chamber can be supplied at extra price.

Any of our Artesian and Tubular Well Cylinders can be used, but Fig. 904 is recommended.

Figure 1454. Sizes, Prices, etc.

Stroke Adjustable Inches	Maximum Sizes of Pipe		Geared	Tight and Loose Pulleys Inches	Approximate Weight in Lbs.	Without Air Chamber		With Air Chamber	
	Suction Inches	Discharge Inches				Cipher	*Price For Belt Drive	Cipher	*Price For Belt Drive
6, 8 or 10	5	3	5 to 1	20 x 3	425	Xykis	$75.00	Xykot	$80.00
12, 16 or 20	6	4	5 to 1	26 x 4	1025	Xykla	150.00	Xykpe	160.00

*Prices for direct connected outfits will be given on application.

Figure 904. Brass Deep Well Cylinder. Sizes, Capacities, Prices, etc.

Gallons Displacement per Minute	Fig. 904 Diameter and Stroke Inches	*10-Inch Head Will Operate in Well Feet	*20-Inch Head Will Operate in Well Feet	Capacity 1 Revolution of Crank Shaft	Rev. per Min.	Top and Bottom Conn. Pipe Inches	Maximum Outside Diameter Inches	Square Wood Sucker Rod Inches	Approx. Weight in Pounds	Cipher	Price All Brass
8.9	2¾ x 10	275	.....	.257 gals.	35	3	3⅞	1½	19	Ximyv	$34.00
15.4	2¾ x 20	.....	300	.514 "	30	3	3⅞	1½	23	Xingy	38.00
12.5	3¼ x 10	200	.....	.359 "	35	3½	4½	2	35	Xinpe	45.00
17.95	3¼ x 20	.....	275	.718 "	25	3½	4½	2	40	Xinyw	52.00
16.7	3¾ x 10	150	.....	.478 "	35	4	5⅛	2¼	53	Xipha	67.50
23.9	3¾ x 20	.....	250	.956 "	25	4	5⅛	2¼	61	Xippi	75.00
21.5	4¼ x 10	120	.....	.614 "	35	4½	5¾	2½	99	Xipyx	87.50
30.7	4¼ x 20	.....	225	1.228 "	25	4½	5¾	2½	104	Xirhe	95.00
26.8	4¾ x 10	100	.....	.767 "	35	5	6¼	3	122	Xirpo	120.00
38.3	4¾ x 20	.....	175	1.534 "	25	5	6¼	3	132	Xiryz	135.00
56.25	5¾ x 20	.....	125	2.25 "	25	6	7¼	3½	179	Zorpy	195.00

* From surface of water in well to point of delivery.

For other sizes of Figure 904 see pages 11 and 12.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Single-Acting Power Working Head

For Operating Single-Acting Deep Well Cylinders
For Wells 50 to 300 Feet Deep

Figure 1518

Fig. 1518. This Working Head is of new design embodying a number of features not found in ordinary low priced working heads. The construction is very strong and substantial, the entire frame being cast in one piece. The gear and crank plate are pressed and keyed on the main shaft The gear and pinion are of charcoal iron, machine cut from the solid. The main and pinion shafts run in large babbitted bearings. The well cover is located at the base. By taking out the bolts which secure the well cover to the frame and disconnecting the well rod, the plunger can be withdrawn from the well without disturbing the pipe connections or moving the working head. The crank plate provides for an adjustable stroke by changing the crank pin. The pitman is of malleable iron and the crosshead and guide rods are of forged steel. The polished well rod operates through a brass gland. All bearings are split, babbitted and provided with oil cups. They are adjustable. Any of our Artesian and Tubular Well Cylinders can be used in connection with this head, but Fig. 904 is recommended. We can supply air chambers at $5 extra list.

We can furnish brass body and all brass in longer strokes.

Dimensions, Capacities and Prices

Stroke Adjustable Inches	Maximum Sizes of Pipes		Geared	Tight and Loose Pulleys Inches	Lift and Force	Approx. Weight in Lbs.	Cipher	Price
	Suction Inches	Discharge Inches						
6, 8 or 10	5	3	5 to 1	16 x 3	2½ in. cyl. 300 ft. 2¾ " " 200 " 3¼ " " 150 " 3¾ " " 110 " 4¼ " " 85 "	375	Xykgy	$80.00

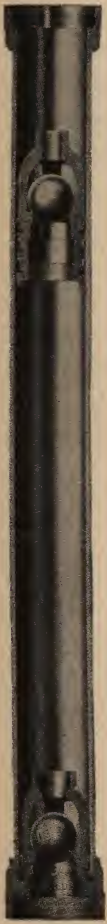
WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Brass Artesian Deep Well Cylinder
Figure 904

Our Special Brass Deep Well Cylinder is intended for use with our differential working heads. The working barrel or cylinder is of heavy seamless drawn brass tubing with cast bronze top and bottom attachments which are threaded for standard iron pipe connections. At the bottom a suction pipe and strainer may be attached. The plunger and check are of bronze with bronze ball valves. The plunger is packed with special hydraulic leather crimps. The plunger and suction valves can be removed and replaced through the connecting pipe, which is of larger diameter than the bore of the cylinder. By turning the plunger rod to the right, the plunger will pick up the suction valve, the top of which is threaded to fit the lower end of the plunger, and both can be withdrawn together. The valve stems and sucker rod couplings are made with standard threads, but can be cut to any special gauge desired.

NOTICE. For convenience in shipping, the plunger and suction valve are screwed together. They *must be disconnected* before the cylinder is lowered into the well. Wood sucker rods with forged couplings are recommended with these cylinders. The price of Fig. 904 Deep Well Cylinder only, is given in the table below. Sucker rods and couplings are furnished at extra cost.

Fi 904. Sizes, Capacities, Prices and Weights



Inside Diameter Inches	Stroke Inches	Capacity per Stroke Gals.	Usual Speed and Capacity per Minute		Dimensions		Top and Bottom Con. Pipes Inches	Wood Sucker Rod Inches	Approximate Weight in Lbs.	Cipher	Price All Brass
			Revs.	Gals.	Length Pump Chamber Inches	Maximum Outside Diameter Caps In.					
1¾	10	.10	35	3.5	26	2⅞	2	1	11	Xilyt	$17.50
1¾	12	.12	30	3.6	38	2⅞	2	1	12	Ximan	19.00
1¾	16	.16	30	4.8	32	2⅞	2	1	13	Ximco	19.00
1¾	20	.20	30	6.0	36	2⅞	2	1	14	Ximep	20.00
1¾	24	.24	25	6.0	40	2⅞	2	1	15	Ximgu	21.00
1¾	30	.30	20	6.0	46	2⅞	2	1	16	Ximir	22.50
2¼	10	.172	35	6.0	26	3½	2½	1¼	14	Ximky	26.00
2¼	12	.206	30	6.2	28	3½	2½	1¼	15	Ximos	28.00
2¼	16	.275	30	8.2	32	3½	2½	1¼	16	Ximpa	28.00
2¼	20	.344	30	10.3	36	3½	2½	1¼	17	Ximte	30.00
2¼	24	.413	25	10.3	40	3½	2½	1¼	18	Ximut	30.00
2¼	30	.516	20	10.3	46	3½	2½	1¼	19	Ximxi	32.00
2¾	10	.257	35	8.9	26	3⅞	3	1½	19	Ximyv	34.00
2¾	12	.309	30	9.3	28	3⅞	3	1½	20	Xinap	36.00
2¾	14	.359	30	10.7	30	3⅞	3	1½	21	Xincu	36.0)
2¾	16	.411	30	12.3	32	3⅞	3	1½	22	Xiner	36.00
2¾	20	.514	30	15.4	36	3⅝	3	1½	23	Xingy	38.00
2¾	24	.617	25	15.4	40	3⅞	3	1½	21	Xinis	38.00
2¾	30	.771	20	15.4	46	3⅞	3	1½	27	Xinla	40.00
2¾	36	.925	20	18.5	52	3⅞	3	1½	30	Xinot	42.00
3¼	10	.359	35	12.5	30	4½	3½	2	35	Xinpe	45.00
3¼	12	.431	30	12.9	32	4½	3½	2	36	Xinti	48.00
3¼	14	.503	30	15.0	34	4½	3½	2	37	Xinuv	48.00
3¼	16	.574	30	17.22	36	4½	3½	2	38	Xinxo	48.00
3¼	20	.718	25	17.95	40	4½	3½	2	40	Xinyw	52.00
3¼	24	.862	25	21.55	44	4½	3½	2	43	Xipar	52.00
3¼	30	1.077	20	21.54	50	4½	3½	2	46	Xipcy	55.00
3¼	36	1.290	20	25.80	56	4½	3½	2	49	Xipes	58.00
3¾	10	.478	35	16.73	34	5⅛	4	2¼	53	Xipha	67.50
3¾	12	.574	30	17 22	36	5⅛	4	2¼	55	Xipit	70.00
3¾	14	.669	30	20.00	38	5⅛	4	2¼	56	Xiple	70.00
3¾	16	.764	30	22.92	40	5⅛	4	2¼	58	Xipov	70.00
3¾	20	.966	25	23.90	44	5⅛	4	2¼	61	Xippi	75.00
3¾	24	1.140	25	28.50	48	5⅛	4	2¼	64	Xipio	75.00
3¾	30	1.430	20	28.86	54	5⅛	4	2¼	69	Xipuw	80.00
3¾	36	1.721	20	34.42	60	5⅛	4	2¼	73	Xipxu	85.00
4¼	10	.614	35	21.49	34	5¾	4½	2½	99	Xipyx	87.50
4¼	12	.737	30	22.11	36	5¾	4½	2½	100	Xiras	90.00
4¼	14	.859	30	25.70	38	5¾	4½	2½	100	Xirda	90.00
4¼	16	.982	30	29.46	40	5¾	4½	3½	101	Xiret	90.00
4¼	20	1.228	25	30.70	44	5¾	4½	2½	104	Xirhe	95.00
4¼	24	1.47	25	36.75	48	5¾	4½	2½	107	Xiriv	95.00
4¼	30	1.840	20	36.80	54	5¾	4½	2½	114	Xirli	100.00
4¼	36	2.211	20	44.20	60	5¾	4½	2½	122	Xirow	105.00
4¾	10	.77	35	26.84	34	6¼	5	3	125	Xirpo	120.00
4¾	12	.92	30	27.60	36	6¼	5	3	126	Xirtu	127.50
4¾	14	1.07	30	32.10	38	6¼	5	3	127	Xirux	127.50
4¾	16	1.22	30	36.81	40	6¼	5	3	129	Xirxy	127.50
4¾	20	1.53	25	38.30	44	6¼	5	3	132	Xiryz	135.00
4¾	24	1.84	25	46.02	48	6¼	5	3	135	Xisat	135.00
4¾	30	2.30	20	46.00	54	6¼	5	3	146	Xisde	142.50
4¾	36	2.76	20	55.20	60	6¼	5	3	158	Xisev	150.50

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Brass Artesian Deep Well Cylinder

Figure 904—Continued

Inside Diameter Inches	Stroke Inches	Capacity per Stroke Gallons	Usual Speed and Capacity per Minute		Dimensions		Top and Bottom Con. Pipes Inches	Wood Sucker Rod Inches	Approximate Weight in Lbs.	Cipher	Price All Brass
			Revs.	Gals.	Length Pump Chamber Inches	Maximum Outside Diameter Caps In.					
5¾	10	1.12	35	39.20	34	7¼	6	3½	170	Xishi	$172.50
5¾	14	1.57	30	47.10	38	7¼	6	3½	174	Xisiw	180.00
5¾	16	1.78	30	53.70	40	7¼	6	3½	176	Xislo	180.00
5¼	20	2.25	25	56.25	44	7¼	6	3½	179	Zorpy	195.00
5¾	24	2.69	25	67.25	48	7¼	6	3½	182	Xisox	195.00
5¾	30	3.37	20	67.44	54	7¼	6	3½	188	Xispu	207.50
5¾	36	4.01	20	80.80	60	7¼	6	3½	194	Xisty	217.50
6¾	16	2.48	30	74.37	40	8¼	7	4	205	Xisuz	280.00
6¾	24	3.72	25	92.90	48	8¼	7	4	212	Xisyb	300.00
6¾	30	4.65	20	92.92	54	8¼	7	4	220	Xisza	320.00
6¾	36	5.58	20	111.52	60	8¼	7	4	228	Xitav	335.00
7¾	16	3.26	30	97.80	40	9½	8	5	235	Xitdi	425.00
7¾	24	4.90	25	122.50	48	9½	8	5	260	Xitew	450.00
7¾	30	6.13	20	122.52	54	9½	8	5	280	Xitho	480.00
7¾	36	7.34	20	146.80	60	9½	8	5	300	Xitix	500.00
8¾	16	4.16	30	124.92	52	11	9	5½	476	Xitlu	685.00
8¾	24	6.24	25	156.17	60	11	9	5½	498	Xitoz	725.00
8¾	30	7.81	20	156.18	66	11	9	5½	514	Xitpy	775.00
8¾	36	9 37	20	187.40	72	11	9	5½	538	Xitub	825.00
9½	24	7.34	25	183.50	78	12	10	6	600	Xitva	915.00
9½	30	9.18	20	183.60	84	12	10	6	616	Xityc	955.00
9½	36	11.02	20	220.40	90	12	10	6	632	Xitze	1,000.00
11½	24	10.77	25	269.25	78	14	12	7¼	900	Xivaw	1,150.00
11½	30	13.47	20	269.40	84	14	12	7¼	924	Xivdo	1,200.00
11½	36	16.16	20	323.20	90	14	12	7¼	948	Xivex	1.250.00

Goulds Well Rods, Couplings and Pin Connections

Connecting Parts for Single-Acting Deep Well Pumps

Fig. 68. Special Forged Well Rod Couplings complete and ready to be attached to well rods. The price includes all sizes used with the deep well pumping apparatus described on preceding pages.

Fig. 77. Wood Well Rods are made of the best material obtainable. The prices include all necessary couplings attached, and are based on standard lengths, 16 to 20 feet each. Shorter lengths at proportionate increase in price.

Fig. 1319. Pin connection or steel substitute for making connection between cylinder plunger and wood rod coupling. One end iron pipe threaded to fit our plungers, the other end threaded same as pin on coupling Fig. 68.

Fig. 1319

Size Square Wood Well Rods Inch	Couplings, etc., have Connecting Threads	Number Threads to the Inch	Inside Diam. of Deep Well Cylinder Inch	Well Rod and Coupling Fig. 77		Approximate Wgt. in Lbs. per Foot	Coupling Fig. 68		Approximate Wgt. in Lbs. per Pair	Steel Substitute Fig. 1319	
				Cipher	Price per Foot		Cipher	Price per Pair		Cipher	Price Each
1	⅝ in. pin	12	1¾	Zufak	$0.12½	½	Xobyk	$1.00	2	Xodfu	$1.50
1¼	⅝ "	12	2¼	Zufca	.15	¾	Xobfo	1.25	3	Xodij	1.50
1½	⅞ "	10	2¾	Zufel	.20	1¼	Xobih	1.50	6	Xodjy	2.00
2	1 "	10	3¼	Zufge	25	1½	Xobju	2.50	9	Xodna	2.50
2¼	1⅛ "	8	3¾	Zufim	.40	2¼	Xobmy	3.75	13	Xodok	3.00
2½	1¼ "	8	4¼	Zufki	.50	3	Xoboj	5.00	18	Xodse	3.50
3	1⅜ "	8	4¾	Zufno	.65	4	Xobsa	6.25	24	Xodul	4.00
3½	1½ "	8	5¾	Zufon	.90	5½	Xobuk	8.75	28	Xodwi	4.50
4	1¾ "	8	6¾	Zufsu	2.75	8¾	Xobwe	55.00	60½	Xodym	5.00
5	2 "	8	7¾	Zufup	5.00	15½	Xobyl	75.00	100	Xofah	6.00
5½	2¼ "	As Ordered	8¾	Zufwy	6.00		Xodag	100.00	120		
6	3 "	As Ordered	9½	Zufyr	7.50	19¼	Xodbo	125.00	156		
7¼	3½ "	As Ordered	11½	Zugal	10.00		Xodeh	150.00			

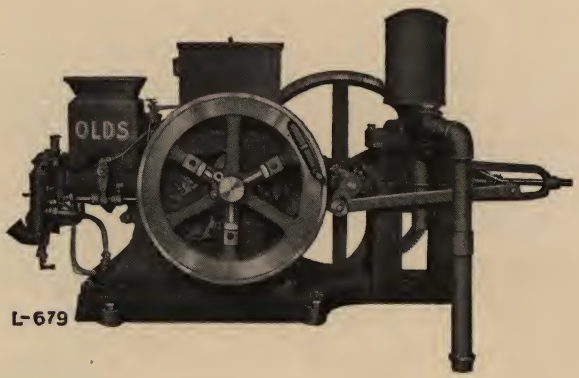
Fig. 77

Fig 68

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Moninger Pneumatic Water Supply System No. 6

Olds 1½ horse-power Engine — Douglas Pump — Horizontal Tank



Here's just the thing where the amount of water needed is not great and the necessary pressure high.

The water to be pumped should not be more than 25 feet below the pump.

The pump is a 2½ by 5-inch double acting pump directly connected to an Olds 1½ horse-power engine and has a capacity of 600 gallons an hour.

This outfit consists of:

1 1½ horsepower engine, direct connected to 2½ by 5-inch double acting pump.

1 36-inch by 10-foot Olds pressure tank. Total capacity, 525 gallons. Working capacity, 350 gallons. (Any size tank can be furnished.)

1 Pressure gauge.

1 Water gauge.

1 1-inch water relief valve.

1 1¼-inch gate valve.

1 1¼-inch check valve.

1 ¾-inch hose bibb.

1 1¼-inch stop and waste cock.

1 Air intake valve.

2 Wood supports for tank.

Pipe and fittings between tank and pump, if not more than 10 feet apart.

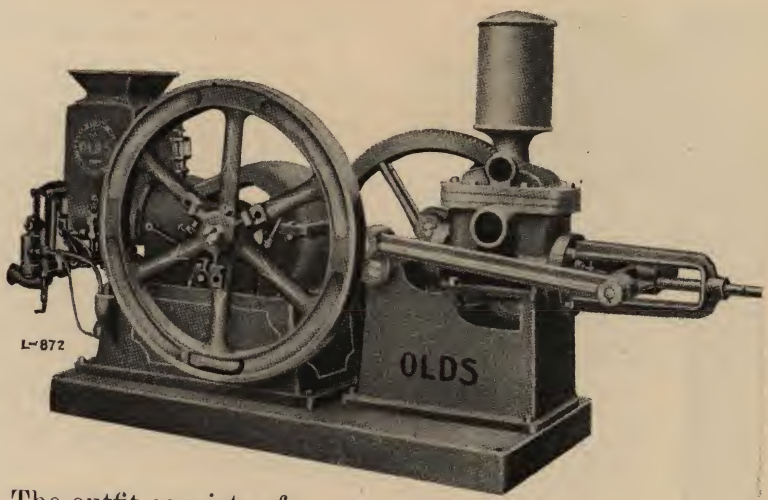
WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Moninger-Olds Pneumatic Water Supply System No. 8

3 horse power Olds Engine; 5x5-inch pump; horizontal tank.

THIS is for use when greater amounts of water are needed.

The pump is the same as used in No. 6 but with four times the capacity, 2500 gallons an hour, and is operated by an Olds 3 horse power engine.



The outfit consists of:

1 3 horse power Olds Engine direct connected to 5 by 5 inch double acting pump, (illustrated).
1 48-inch by 12-foot tank. Total capacity 1130 gallons. Working capacity 750 gallons. (Any size tank can be furnished).
1 water gauge.
1 pressure gauge.
1 ½-inch gate valve.
1 1-inch water relief valve.
1 1½-inch horizontal check valve.
1 1¼-inch stop and waste cock.
1 ¾-inch hose bibb.
1 air intake valve.
2 wood supports for a tank.
Pipe and fittings between tank and pump, if not more than 10 feet apart.

OTHER OUTFITS DESCRIBED ON REQUEST.

WATER SUPPLY OUTFITS—PUMPS AND ENGINES.

Fig. 643

Skinner System of Irrigation

Let us quote you on your requirements along this line.

The Automatic Watering System saves time and labor for you and does the work better. You can't afford to be without it if you are looking for the best at the least cost to install. The upkeep of this system is very small.

Fig. 644

What is the Skinner System?

The Skinner System of Irrigation was first conceived by a practical gardener whose extensive experience with the then existing, so called systems of irrigation, has served only to show their imperfections and unsatisfactory operation. Its present degree of perfection has been attained after years of exhaustive experiment and innumerable tests upon widely differing crops grown under diverse conditions, in this and other countries.

The System would, in a broad classification, be considered an overhead system, as the water is applied to the growth from "overhead."

Distribution of water over the greenhouse is accomplished through a system of carefully designed and accurately constructed brass nozzles, located in such positions and at such distances as will secure an absolutely uniform distribution of water.

The Skinner Greenhouse Nozzle is of patented design, and is the result of ten years' experience. The water, in passing from the nozzle, is broken into finely disseminated particles and descends upon the plant and soil in the form of a finely diffused mist.

The feed line in which the nozzles are set is at its head equipped with a Skinner Patented Union, which permits of the ready rotation of the pipe, whereby the water may be distributed over an area approximately 16 feet in width.

Both the unions and the nozzles are equipped with specially designed patented filters, which reduces to a minimum and practically eliminates the difficulty of clogging in the nozzles.

Fig. 645

Fig. 646

Fig. 647

Outdoor Nozzle. Lawn-Sprinkler Nozzle. Greenhouse Nozzle.

Handy Data on Power Pumping.

Directions for Installing and Operating Power Pumps

INSTALLING

Location The pump should be located as near the source of supply as possible. Never under any circumstances exceed the height and distance from the source of supply, given in the table on Suction Lift of Pumps, page 11. When **hot** and **thick** liquids are to be handled, they should always flow to the pump. It is always advisable to place the pump so that it can be readily reached from all sides.

Foundation Our Power Pumps are all self contained and are not dependent upon foundations to maintain correct alignment of the working parts, but a good foundation is essential to preserve the correct position of the pump in relation to its driving mechanism, and to avoid undue strain upon the pipe connections. The pump should therefore, be placed upon a level and secure foundation. For many of our smaller pumps, a good plank floor, such as is found in any well-built mill or factory is sufficient, but for the large heavier pumps, a substantial concrete foundation with anchor bolts, should be provided. Where such foundations are to be made, plans will be sent so that the foundation work can be completed before the arrival of the pump.

PIPING

Piping in General Run all piping in as direct a line as possible; avoid all unnecessary turns; see that all joints and connections are tight, and if the pipe lines are long, use larger size pipe than that listed for our pumps, in order to reduce friction and to keep down the pressure on the pump. This will prove economical in the long run. To illustrate: Suppose a pump is discharging 100 gallons per minute through a three inch pipe, 1000 feet in length. From the friction table for iron pipe, page 11, it will be seen that the loss of head for 100 feet of 3 inch pipe discharging 100 G. P. M. is 3.52 feet, which for 1000 feet of pipe means a loss of 35.2 feet. If in place of 3 inch pipe,4 inch pipe were used, the corresponding loss would be .88 feet per 100 feet of length, or 8.8 feet for 1000 feet of pipe The saving in pressure on the pump would therefore be 35.2—8.8=26.4 feet, which is equivalent to approximately 11.4 lbs. pressure per sq. in.

Suction Pipe The suction pipe in particular must be absolutely air tight as a small leak in it will greatly impair the operation of the pump. It should in no case be smaller than the size given in our bulletin table, and if very long, it should always be larger. In laying the suction pipe, a uniform grade should be maintained throughout to avoid air pockets, and if possible the lines should have a drop of not less than 6 inches in each 100 feet length toward the source of supply.

Vacuum Chamber The addition of a Vacuum Chamber greatly aids and steadies the suction flow, and one should be used on high suction lifts. Where it is possible, the Vacuum Chamber should be mounted on the pump, on the side opposite the suction intake.

Foot Valve When the total suction lift exceeds 15 feet, or the suction line is over 100 feet long, it is advisable to place a Foot Valve on the end of the suction pipe, as this keeps the pipe and pump chamber filled with water, thus avoiding the possible necessity of priming the pump each time it is started.

Strainer If the source of supply is at a point where foreign substances may be drawn into the pump with consequent clogging of the valves, a strainer of good liberal area should be used on the suction pipe; preferably one that can be examined and cleaned occasionally

Water Relief Valve A Water Relief Valve of ample size, set at a pressure slightly above that at which pump is to operate, must be placed between the pump and any shut-off valve in the discharge pipe, in order to avoid damage in case the pump is started with the gate valve closed. We disclaim all responsibility for any break that

Handy Data on Power Pumping.

may occur in a pump that does not have an ample relief valve between the pump and any shut-off valve in the discharge pipe.

Gate Valves Always use Gate Valves, not Globe Valves. Globe Valves increase the friction, while Gate Valves offer an unrestricted passage. It is advisable to place a gate valve at or near the pump in both suction and discharge pipes, so that the valve may be closed when it is found necessary to examine the pump.

Drain Pipes Each cylinder is provided with suitable openings at the top to which small drain pipes may be connected for carrying off any water that may accumulate around the stuffing box glands.

OPERATING

All Pumps are thoroughly tested before leaving the factory and shipped in perfect condition. If properly assembled they will work satisfactorily at once, and if they do not, remember that the pump has operated satisfactorily before shipment under the conditions for which it was sold, and will do so again.

Priming If the pump takes its suction under difficult conditions and there is air in the suction pipe and pump, it may be necessary to prime the pump and allow the air to escape through pet cocks or plugs which are provided in the discharge valve boxes.

To prime the pump, take off the covers from the discharge valve boxes, lift the valves and fill the cylinders with water.

All Centrifugal Pumps must be primed before starting. For this purpose a special priming arrangement is necessary.

Priming Pipes The priming pipes are often made a permanent fixture. They are connected between the discharge line and the pump cylinders, and must contain a gate valve.

Glands Do not screw the glands down too tight, especially when starting a pump for the first time, as the packing swells and will produce unnecessary friction and wear, increasing the amount of power necessary to operate the pump. Tighten the glands enough to prevent leakage only. Excessive tightening of the glands on new packing is also apt to split the cylinder.

Packing It is advisable to soak new piston packing in warm water for some hours before fitting it in place. When starting a pump for the first time, do not crowd the packing too tightly into place. In some instances cylinders have been split as a result of this practice. Fit in snugly without using undue force. Renew packing before it becomes hard and cuts the plunger or piston.

Valves The valves should be examined occasionally to see if they are seating properly. Foreign substances are apt to be drawn up through the suction pipe and become lodged between the valve and seat, causing leakage and a corresponding reduction in the capacity of the pump.

When metal valves are used, they should be ground to the seats occasionally, to insure proper operation.

Lubrication The bearings should be carefully cleaned after the pump is installed. Keep all bearings well lubricated. Metal gearing should also be oiled to prevent possible cutting, **(except when rawhide pinions are furnished)**.

Rawhide Pinions **Use no oil on rawhide pinions;** use Flaked Graphite only. Rawhide Pinions should be protected from possible contact with moisture or they will be destroyed.

Adjustment Particular attention should be given to see that bearings do not become loose. Adjustment is provided for all bearings for taking up the wear. At the first indication of a loose bearing cap or box, the matter should be attended to **at once.** A loose bearing on a pump, as on an engine, if neglected, is apt to do considerable damage to the driving parts, causing "pounding," excessive wear, "chattering," faulty meshing of the gears, and possible breakage.

Handy Data on Power Pumping.

By-Pass Pumps driven by mechanisms which do not start easily under full load are usually equipped with a By-Pass. In such cases the By-Pass should be opened before starting and gradually closed as the pump gains speed.

Freezing If a pump is located where there is danger of freezing when idle, it should be entirely drained. Drain plugs or cocks are provided for this purpose.

REPAIRS

Shop Number In ordering repairs **always** give our "Shop Number," which will be found on the name plate and stamped on the end of the crank shaft. We can then supply any new part required that will fit the old part accurately, as careful records are kept of every pump we build.

Economy of Pumping with Goulds Efficient Power Pumps

To pump water or other fluids against a head or resistance, power is required. The theoretical, useful and effective power used in such operations is the amount of work per unit of time required to move the given quantity of fluid from the point of supply to the point of delivery in the given time. In addition to this theoretical amount, power is also required to overcome the fluid friction in the pipes and pump, and to overcome the mechanical friction of the pumping equipment itself. These quantities, or power losses, will be larger or smaller, depending upon the construction of the pump—whether the fluid is forced along in jerks through sharp angular turns or whether it moves steadily through smooth, easy curves as it does in the Goulds Efficient Triplex Power Pump.

The efficiency of a pump is the proportion the theoretical power bears to the whole amount of power expended and is, therefore, a factor of prime importance in pumping economy. The Goulds Efficient Triplex Power Pump, by its continuous and uniform action upon the fluid being pumped and by its superior mechanical excellence performs the work of pumping in the most Efficient and Economical manner possible.

The Triplex Pump is driven by a belt from a Line Shaft, by an Electric Motor, by a Gas or Gasoline Engine, by a Separate Steam Engine, Water Wheel or other Power Equipment.

The full measure of Efficiency in power pumping, therefore, depends also upon the economy of the motive power. Water power is the cheapest of all. Steam Engines of economical type use about 1½ pounds of coal per horse power hour, and grade from this to 5 pounds or more for small engines of the simple type. Gas, Fuel Oil and Gasoline Engines are highly economical. Electric pumping is particularly convenient and often more economical than other power.

Direct-acting Steam Pumps, both duplex and single, have been extensively used and have served a useful purpose where conditions were crude and where rapid development was more essential than economy. They are necessarily extravagant in the use of fuel, even when in the best condition, and are liable to great losses by being used with leaky steam valves and pistons. Careful tests under favorable conditions do not show good and economical results, and their use cannot be tolerated by the Manager striving to attain maximum earning power for his plant. Their poor economy is fairly contrasted with the high economy of the Efficient Triplex Power Pump in the following tabulated data on the fuel consumption of different pumping equipments:

Efficient Triplex Power Pump and Steam Engine, 1½ to 5 lbs. of coal per horse power hour.
Efficient Triplex Power Pump and Gasoline Engine, 1 pint of gasoline per horse power hour.
Efficient Triplex Power Pump and Oil Engine, 1 pint of oil per horse power hour.
Efficient Triplex Power Pump and Gas Engine, 10 to 20 cubic feet of gas per horse power hour.
Efficient Triplex Power Pump and Electric Motor, 1½ to 4c per 1,000 Watt Hours or 1c to 3c per horse power hour.
Small Steam Pumps, about 25 lbs. of coal per horse power hour.

Handy Data on Power Pumping.

Large Steam Pumps, Compounded, about 13 lbs. of coal per horse power hour.
Pulsometers, about 67 lbs. of coal per horse power hour.
Injectors and Inspirators, about 100 lbs. of coal per horse power hour.

NOTE: The motor figures cover total power cost, including fuel, attendance, water, oil, etc. The others cover fuel consumption only.

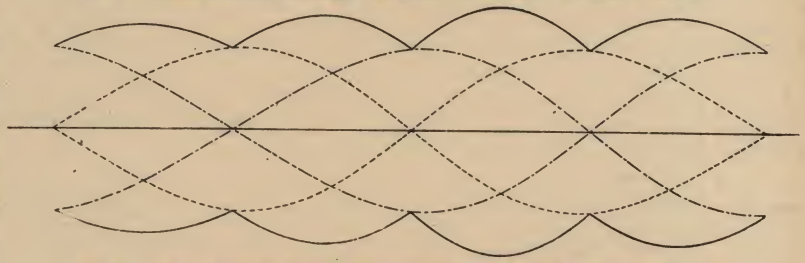
Rate of Suction and Discharge in Pumps

Operated by Crank Shaft, Without Air Chamber

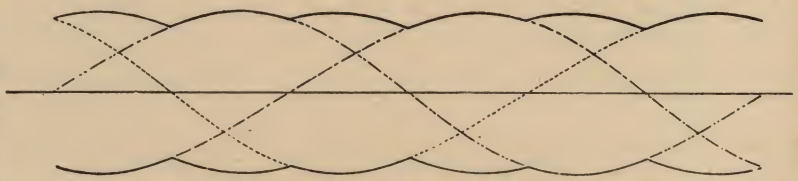
No. 1. Shows the rate of suction and discharge, during one revolution of a crank shaft, operating two single-acting plungers, with cranks 180 degrees apart, or one double acting piston.

No. 1. One Double-Acting Piston or two Single-Acting Plungers

No. 2. Shows the rate of suction and discharge, indicated by the dotted and broken lines, of the individual plungers or pistons, and also the resultant rate of suction and discharge, indicated by the full lines, of the same plungers or pistons working together, during one revolution of a crank shaft which operates four single-acting plungers with cranks 90 degrees apart, or two double acting pistons with cranks at right angles.

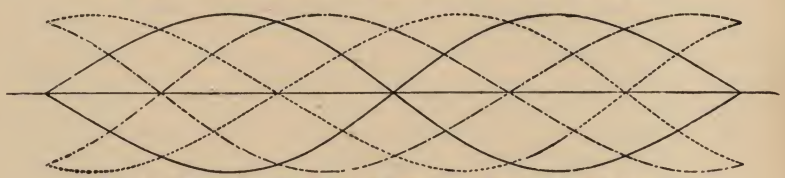


No. 2. Two Double-Acting Pistons or four Single-Acting Plungers



No. 3. Three Single-Acting Plungers— Cranks 120° Apart

No. 3. Shows the rate of suction and discharge of the individual plungers, and also the resultant rate of suction and discharge of the same plungers working together, during one revolution of a crank shaft which operates three single-acting plungers with cranks 120 degrees apart.



No. 4. Three Double-Acting Pistons—Cranks 120° Apart

No. 4. Shows the rate of suction and discharge, indicated by the interlacing lines, of the individual pistons during one revolution of a crank shaft, operating three double-acting pistons with cranks 120 degrees apart. The resultant of these lines, not shown, is a trifle nearer straight than the resultant in No. 3, indicating a slight difference in the rate of suction and discharge between the Triplex Single-Acting and the Triplex Double-Acting Pump.

Handy Data on Power Pumping.

Table of Capacities of Pumps

Figures are for One Single-Acting Cylinder—For Single-Acting Triplex Pumps Multiply by Three

Diam. of Cyl., Ins	Area, Square Inches	Length of Stroke in Inches: 2	3	4	5	6	7	8	9	10	12	14	15	16	18	20	24	Diam. of Cyl., Ins.
		Capacity per Stroke in Gallons or Decimal Parts Thereof																
1/2	.196	.002	.003	.003	.004	.005	.006	.007	.008	.009	.010	.012	.013	.014	.015	.017	.020	1/2
5/8	.307	.003	.004	.005	.007	.008	.009	.011	.012	.013	.016	.019	.020	.021	.024	.027	.032	5/8
3/4	.442	.004	.006	.008	.010	.011	.013	.015	.017	.019	.023	.027	.029	.031	.034	.038	.046	3/4
7/8	.601	.005	.008	.010	.013	.016	.018	.021	.023	.026	.031	.036	.039	.042	.047	.052	.062	7/8
1	.785	.007	.010	.014	.017	.020	.024	.027	.031	.034	.041	.048	.051	.054	.061	.068	.082	1
1 1/8	.994	.009	.013	.017	.022	.026	.030	.034	.039	.043	.052	.060	.065	.069	.077	.086	.103	1 1/8
1 1/4	1.227	.011	.016	.021	.027	.032	.037	.043	.048	.053	.064	.074	.079	.085	.096	.106	.127	1 1/4
1 3/8	1.485	.013	.019	,026	.032	.039	.044	.051	.058	.064	.077	.089	.096	.103	.116	.128	.154	1 3/8
1 1/2	1.767	.015	.023	.031	.038	.046	.054	.061	.069	.077	.092	.107	.115	.122	.138	.153	.184	1 1/2
1 3/4	2.405	.021	.031	.042	.052	.063	.073	.083	.094	.104	.125	.146	.156	.170	.187	.208	.249	1 3/4
2	3.142	.027	.041	.054	.068	.082	.095	.109	.122	.136	.163	.190	.204	.218	.245	.272	.326	2
2 1/4	3.976	.034	.052	.069	.086	.103	.121	.138	.155	.172	.206	.241	.258	.275	.309	.344	.413	2 1/4
2 1/2	4.909	.043	.064	.085	.106	.128	.149	.170	.191	.213	.255	.298	.319	.340	.383	.425	.510	2 1/2
2 3/4	5.940	.051	.077	.103	.129	.154	.180	.206	.231	.257	.309	.360	.386	.411	.463	.514	.617	2 3/4
3	7.069	.061	.092	.122	.153	.184	.214	.245	.275	.306	.367	.428	.459	.489	.551	.612	.734	3
3 1/4	8.296	.072	.108	.144	.179	.215	.251	.287	.323	.359	.431	.503	.539	.575	.647	.718	.862	3 1/4
3 1/2	9.621	.083	.125	.167	.208	.249	.292	.333	.375	.417	.499	.583	.625	.666	.750	.833	.999	3 1/2
3 3/4	11.045	.095	.143	.191	.239	.287	.335	.382	.430	.478	.574	.669	.717	.765	.861	.956	1.147	3 3/4
4	12.566	.109	.163	.218	.272	.326	.381	.435	.490	.544	.653	.762	.816	.870	.979	1.088	1.306	4
4 1/4	14.186	.123	.184	.246	.307	.368	.429	.491	.553	.614	.737	.860	.921	.982	1.105	1.228	1.473	4 1/4
4 1/2	15.904	.138	.207	.275	.344	.413	.482	.551	.619	.689	.826	.964	1.033	1.102	1.239	1.377	1.652	4 1/2
4 3/4	17.721	.153	.230	.307	.384	.460	.537	.614	.690	.767	.920	1.073	1.150	1.227	1.380	1.534	1.841	4 3/4
5	19.635	.170	.255	.340	.425	.510	.595	.680	.765	.850	1.020	1.190	1.275	1.360	1.530	1.700	2.040	5
5 1/4	21.648	.187	.281	.375	.469	.562	.656	.750	.843	.937	1.124	1.311	1.405	1.499	1.686	1.874	2.248	5 1/4
5 1/2	23.758	.206	.309	.411	.514	.617	.720	.823	.926	1.029	1.234	1.440	1.543	1.646	1.851	2.057	2.468	5 1/2
5 3/4	25.967	.225	.337	.449	.562	.674	.787	.899	1.011	1.124	1.348	1.573	1.686	1.798	2.022	2.248	2.696	5 3/4
6	28.274	.245	.367	.489	.612	.734	.857	.979	1.102	1.224	1.469	1.714	1.836	1.958	2.203	2.448	2.938	6
6 1/4	30.680	.266	.398	.531	.664	.797	.929	1.062	1.195	1.328	1.593	1.859	1.992	2.124	2.390	2.656	3.186	6 1/4
6 1/2	33.183	.287	.431	.574	.718	.861	1.005	1.149	1.293	1.436	1.796	2.011	2.155	2.298	2.589	2.873	3.447	6 1/2
6 3/4	35.785	.309	.465	.619	.775	.929	1.084	1.239	1.394	1.549	1.858	2.168	2.323	2.479	2.788	3.098	3.716	6 3/4
7	38.485	.333	.499	.666	.833	.999	1.166	1.333	1.499	1.666	1.999	2.332	2.499	2.666	2.999	3.332	3.998	7
7 1/2	44.179	.383	.574	.765	.956	1.148	1.339	1.530	1.721	1.913	2.295	2.678	2.869	3.060	3.443	3.825	4.590	7 1/2
7 3/4	47.173	.408	.613	.817	1.021	1.225	1.429	1.633	1.837	2.042	2.450	2.858	3,063	3.267	3.675	4.084	4.900	7 3/4
8	50.266	.435	.652	.870	1.088	1.306	1.523	1.741	1.958	2.176	2.611	3.046	3.264	3.482	3.917	4.352	5.222	8
8 1/2	56.745	.491	.736	.982	1.225	1.473	1.719	1.964	2.210	2.456	2.947	3.438	3.684	3.929	4.420	4.912	5.894	8 1/2
8 3/4	60.132	.520	.780	1.041	1.301	1.561	1.822	2.082	2.342	2.603	3.123	3.644	3.904	4.164	4.685	5.206	6.247	8 3/4
9	63.617	.551	.826	1.101	1.377	1.652	1.928	2.203	2.479	2.754	3.305	3.856	4.131	4.406	4.957	5.508	6.609	9
9 1/2	70.882	.613	.920	1.227	1.534	1.840	2.147	2.454	2.761	3.068	3.681	4.295	4.620	4.908	5.523	6.136	7.344	9 1/2
9 3/4	74.662	.646	.969	1.293	1.616	1.939	2.262	2.585	2.908	3.232	3.878	4.525	4.848	5.171	5.817	6.464	7.758	9 3/4
10	78.540	.680	1.020	1.360	1.700	2.040	2.380	2.720	3.060	3.400	4.080	4.760	5.100	5.440	6.120	6.800	8.160	10
11	95.033	.823	1.234	1.645	2.057	2.464	2.879	3.291	3.726	4.114	4.937	5.760	6.171	6.582	7.405	8.228	9.874	11
11 1/2	103.869	.899	1.348	1.798	2.248	2.697	3.147	3.597	4.046	4.496	5.395	6.295	6.744	7 194	8.093	8.992	10.790	11 1/2
12	113.098	.979	1.468	1.958	2.448	2.938	3.422	3.917	4.406	4.896	5.875	6.854	7.344	7.833	8.813	9.792	11.750	12.
13	132.733	1.149	1.723	2.297	2.872	3.445	4.022	4.596	5.170	5.745	6.894	8.042	8.619	9.193	10.342	11.492	13.790	13
14	153.938	1.332	1.998	2.665	3.331	3.997	4.664	5.330	5.996	6.663	7.994	9.328	9.994	10.660	11.993	13.326	15.991	14
14 1/2	165.130	1.430	2.142	2.856	3.574	4.284	5.004	5.718	6.426	7.148	8.578	10.008	10.722	11.424	12.852	14.296	17.136	14 1/2
15	176.715	1.530	2.295	3.060	3.825	4.590	5.355	6.120	6.885	7.650	9.178	10.710	11.475	12.240	13.770	15.300	18.360	15
16	201.062	1.740	2.610	3 481	4.351	5.221	6 092	6.962	7 832	8.703	10.443	12.184	13.054	13.924	15.665	17.406	20.887	16
18	254.470	2.202	3.303	4.404	5.506	6.607	7.708	8.809	9.910	11.012	13.214	15.416	16 518	17.619	19.821	22.024	26.428	18
20	314.160	2.720	4 080	5 440	6.800	8.160	9.520	10.880	12.240	13.600	16.320	19.040	20.400	21.760	24.480	27.200	32.640	20

Standard Dimensions of Wrought Iron Pipe and Light Well Casing

Light Wrought Iron Well Casing: Inside Diameter	Outside Diameter	Threads per inch	Outside diam. of Coupling	Wrought Iron, Gas and Water Pipe Standard Dimensions: Inside Diameter	Outside Diameter	Threads per inch	Diam. of Couplings	Length of Couplings
2 in.	2 1/4 in.	14	2 3/4 in.	1/8 in.	0.405 in.	27	41/64 in.	15/16 in.
2 1/4 "	2 1/2 "	14	2 31/32 "	1/4 "	0.54 "	18	2 23/32 "	1 "
2 1/2 "	2 3/4 "	14	3 1/4 "	3/8 "	0.675 "	18	57/64 "	1 1/4 "
2 3/4 "	3 "	14	3 15/32 "	1/2 "	0.84 "	14	1 1/16 "	1 7/16 "
3 "	3 1/4 "	14	3 3/4 "	3/4 "	1.05 "	14	1 3/8 "	1 5/8 "
3 1/4 "	3 1/2 "	14	4 "	1 "	1.315 "	11 1/2	1 43/64 "	1 15/16 "
3 1/2 "	3 3/4 "	14	4 9/32 "	1 1/4 "	1.66 "	11 1/2	2 1/32 "	2 "
3 3/4 "	4 "	14	4 17/32 "	1 1/2 "	1.9 "	11 1/2	2 11/32 "	2 1/4 "
4 "	4 1/4 "	14	4 25/32 "	2 "	2.375 "	11 1/2	2 7/8 "	2 3/4 "
4 1/4 "	4 1/2 "	14	5 5/32 "	2 1/2	2.875 "	8	3 9/32 "	3 1/8 "
4 1/2 "	4 3/4 "	14	5 3/8 "	3 "	3.5 "	8	4 "	3 3/16 "
4 3/4 "	5 "	14	5 5/8 "	3 1/2 "	4. "	8	4 17/32 "	3 3/8 "
5 "	5 1/4 "	14	5 7/8 "	4 "	4.5 "	8	5 1/16 "	3 1/4 "
5 3/16 "	5 1/2 "	14	6 1/16 "	4 1/2 "	5. "	8	5 11/16 "	3 5/8 "
5 5/8 "	6 "	14	6 9/16 "	5 "	5.563 "	8	6 1/4 "	3 5/8 "
6 1/4 "	6 5/8 "	14	7 1/4 "	6 "	6.625 "	8	7 7/16 "	3 1/2 "
6 5/8 "	7 "	14	7 39/64 "	7 "	7.625 "	8	8 13/32 "	4 "
7 1/4 "	7 5/8 "	14	8 3/8 "	8 "	8.625 "	8	9 3/8 "	4 "
7 5/8 "	8 "	14	8 23/32 "	9 "	9.688 "	8	10 29/32 "	6 1/16 "
8 1/4 "	8 5/8 "	11 1/2	9 3/8 "	10 "	10.75 "	8	11 31/32 "	6 1/16 "
8 5/8 "	9 "	11 1/2	9 13/16 "	11 "	11.75 "	8		
9 5/8 "	10 "	11 1/2	11 "	12 "	12.75 "	8		

Handy Data on Power Pumping.

Table for Equalizing Pipes

The size of main pipe is given in the column at the left. The number of branches is given in the line on top, and the proper size of branches is given in the body of the table on the line of each main and beneath the desired number of branches.

In commercial sizes the nominal 1¼-inch pipe is generally over-size: often as large as 1⅜. It is safe to call it 1.3 inches, and it is so figured in the table. Exact sizes are given for branch pipes. The designer of the pipe system can thus better select the commercial sizes to be used.

Copied by permission from the Catalog of the Norwalk Iron Works Co., South Norwalk, Conn.

Size of Main Pipe	Number of Branches.														
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 in.	.758	.644	.574	525	.488	.459	.435	.415	.398	.383	.370	.358	.348	.338	.330
1¼ "	.985	.838	.747	.683	.635	.597	.556	.540	.518	.498	.482	.466	.452	.440	.428
1½ "	1.14	.967	.861	.788	.733	.689	.653	.623	.597	.575	.555	.538	.522	.508	.494
2 "	1.52	1.29	1.15	1.05	.977	.918	.870	.830	.796	.766	.740	.717	.696	.677	.660
2½ "	1.89	1.61	1.44	1.31	1.22	1.15	1.09	1.09	.995	.958	9.25	.896	.870	.846	.825
3 "	2.27	1.92	1.72	1.58	1.47	1.38	1.31	1.25	1.19	1.15	1.11	1.08	1.04	1.02	.989
3½ "	2.65	2.26	2.01	1.84	1.71	1.61	1.52	1.45	1.39	1.34	1.30	1.25	1.22	1.18	1.15
4 "	3.03	2.58	2.30	2.10	1.95	1.84	1.74	1.66	1.59	1.53	1.48	1.43	1.39	1.35	1.32
4½ "	3.41	2.90	2.58	2.36	2.20	2.07	1.96	1.87	1.79	1.72	1.67	1.61	1.57	1.52	1.48
5 "	3.79	3.22	2.87	2.63	2.44	2.30	2.18	2.08	1.99	1.92	1.85	1.79	1.74	1.69	1.65
6 "	4.55	3.87	3.45	3.15	2.93	2.75	2.61	2.49	2.39	2.30	2.22	2.15	2.09	2.03	1.98
7 "	5.30	4.51	4.02	3.68	3.42	3.21	3.05	2.91	2.79	2.68	2.59	2.51	2.44	2.37	2.31
8 "	6.06	5.16	4.59	4.20	3.91	3.67	3.48	3.32	3.18	3.09	2.96	2.87	2.78	2.71	2.64
9 "	6.82	5.80	5.17	4.73	4.40	4.13	3.92	3.74	3.58	3.45	3.33	3.23	3.13	3.04	2.97
10 "	7.58	6.44	5.74	5.25	4.88	4.59	4.35	4.15	3.98	3.83	3.70	3.59	3.48	3.38	3.30
12 "	9.08	7.73	6.89	6.30	5.86	5.51	5.22	4.98	4.78	4.60	4.44	4.30	4.18	4.06	3.96

Rules to Determine the Size and Speed of Pulleys and Gears

The driving pulley is called the Driver, and the driven pulley the Driven.

If the number of teeth in the gear are used in these calculations instead of the diameter, the number of teeth must be substituted whenever diameter occurs.

To find the diameter of the driver, the revolutions of the driver, the revolutions of the driven and the diameter of the driven being given: Multiply the diameter of the driven by its revolutions and divide the product by the revolutions of the driver; the quotient will be the diameter of the driver.

To find the diameter of the driven, the revolutions of the driven, the revolutions of the driver and the diameter of the driver being given: Multiply the diameter of the driver by its revolutions and divide the product by the revolutions of the driven; the quotient will be the diameter of the driven.

To find the revolutions of the driver, the diameter of the driver, the diameter of the driven and the revolutions of the driven being given: Multiply the diameter of the driven by its revolutions and divide the product by the diameter of the driver; the quotient will be the revolutions of the driver.

To find the revolutions of the driven, the diameter of the driven, the diameter of the driver and the revolutions of the driver being given: Multiply the diameter of the driver by its revolutions and divide the product by the diameter of the driven; the quotient will be the revolutions of the driven.

Handy Data on Power Pumping.

Diameter of Pulleys with Corresponding Belt Speeds and Horse Power Belting will Transmit

Diameter of Pulley in Inches	Belt Speed in Feet per Minute per 100 R. P. M.	Corresponding Horse Power Transmitted per 1 in. Belt Width	
		Single Belt	Double Belt
3.	78.6	.095	.190
3.82	100.	.121	.242
4.	105.	.127	.254
5.	131.	.158	.316
6.	157.	.190	.380
8.	210.	.254	.508
10.	262.	.317	.634
12.	314.	.380	.760
14.	366.	.443	.886
15.	393.	.475	.950
16.	419.	.507	1.01
18.	471.	.570	1.14
20.	524.	.634	1.27
22.	576.	.697	1.39
24.	628.	.760	1.52
26.	680.	.823	1.64
28.	733.	.888	1.77
30.	785.	.950	1.90
32.	838.	1.01	2.02
34.	890.	1.08	2.16
36.	942.	1.14	2.28
38.	995.	1.20	2.40
40.	1048.	1.26	2.52
42.	1100.	1.33	2.66
48.	1256.	1.52	3.04
54.	1415.	1.71	3.42
60.	1570.	1.90	3.80
66.	1722.	2.08	4.16
72.	1884.	2.28	4.56

R. P. M.=Revolutions per Minute.

To find the Belt Speed in Feet per Minute for any size pulley and any number of revolutions per minute: Multiply the diameter of the pulley in inches by the revolutions per minute, and multiply the product by .262

To find the Horse Power for any width belt and any speed: Multiply the belt speed in feet per minute by the width of the belt in inches, and multiply the product by .00121 for a single ply belt, or by .00242 for a double ply belt. The final result is the horse power which the belt will transmit.

Example: What is the speed of a belt running over a 42 inch pulley turning at 180 R. P. M.?

Answer: Belt speed=42 x 180 x .262=1980 ft. per min.

Example: What horse power will a 6 inch single ply belt transmit when traveling at this speed?

Answer: Horse power=1980 x 6 x .00121=14.38.

Note:—The horse power which a belt will transmit as given in the above tables is based on the assumption that the pulleys are both of equal diameter or nearly so. When one pulley is several times larger than the other an extra allowance of width should be made to insure satisfactory transmission of the full amount of power. **It is always best to have a liberal sized belt for all cases,** as the liability of trouble of all kinds is minimized and the life of the belt is greatly prolonged.

Handy Data on Power Pumping.

Horse Power Shafting Will Transmit

Diameter of Shaft in Inches	Revolutions per Minute									
	100	125	150	175	200	225	250	300	350	400
15-16	1.2 h.p	1.4 h.p	1.7 h.p	2.1 h.p	2.4 h.p.	2.6 h.p.	3.1 h.p	3.6 h.p	4.3 h.p	5.0 h.p.
1 3-16	2.4 "	3.1 "	3.7 "	4.3 "	4.9 "	5.5 "	6.1 "	7.3 "	8.5 "	9.7 "
1 7-16	4.3 "	5.3 "	6.4 "	7.4 "	8.5 "	9.5 "	10.5 "	12.7 "	14 8 "	16.9 "
1 11-16	6.7 "	8.4 "	10.1 "	11.7 "	13.4 "	15.1 "	16.7 "	20.1 "	23.4 "	26.8 "
1 15-16	10.0 "	12.5 "	15.0 "	17.5 "	20.0 "	22.5 "	25.0 "	30.0. "	35.0 "	40.0 "
2 3-16	14.3 "	17.8 "	21.4 "	24.9 "	28.5 "	32.1 "	35.6 "	42.7 "	49.8 "	57.0 "
2 7-16	19.5 "	24.4 "	29.3 "	34.1 "	39.0 "	44.1 "	48.7 "	58.5 "	68.2 "	78.0 "
2 11-16	26.0 "	32.5 "	39.0 "	43.5 "	52.0 "	58.5 "	65.0 "	78.0 "	87.0 "	104.0 "
2 15-16	33.8 "	42.2 "	50.6 "	59.1 "	67.5 "	75.9 "	84.4 "	101.3 "	118.2 "	135.0 "
3 3-16	43.0 "	53.6 "	64.4 "	75.1 "	85.8 "	96.6 "	107.3 "	128.7 "	150.3 "	171.6 "
3 7-16	53.6 "	67.0 "	79.4 "	93.8 "	107.2 "	120.1 "	134.0 "	158.8 "	187.6 "	214.4 "
3 11-16	65.9 "	82.4 "	97.9 "	115.4 "	121.8 "	148.3 "	164.8 "	195.7 "	230.7 "	243.6 "
3 15-16	80.0 "	100.0 "	120.0 "	140.0 "	160.0 "	180.0 "	200.0 "	240.0 "	280.0 "	320.0 "
4 7-16	113.9 "	142.4 "	170.8 "	199.3 "	227.8 "	256.2 "	284.7 "	341.7 "	398.6 "	455.6 "
4 15-16	156.3 "	195.3 "	234.4 "	273.4 "	312.5 "	351.5 "	390.6 "	468.7 "	546.8 "	625.0 "

Useful Information Water

One cubic inch weighs .0361 pounds.

One cubic foot equals 62.4245 pounds at 39 degrees F., equals 7.48 gallons U. S. or 6.2321 gallons imperial.

One pound equals 27.7 cubic inches.

One gallon U. S. equals 8.33111 pounds; equals 231 cubic inches, equals .113368 cubic feet

One imperial gallon equals 10 pounds at 62 degrees F., equals 277.274 cubic inches, equals .16046 cubic feet.

To convert imperial gallons to U. S. gallons, multiply by the factor 1.2.

To convert U. S. gallons into imperial gallons, multiply by the factor .8333.

A Miner's Inch is a measure for flow of water, and is the quantity of water that will flow in one minute through an opening one inch square in a plank 2 inches thick under a head of 6½ inches to the center of the orfice. This is equivalent, approximately, to 1.2 cubic feet, or 9 gallons per minute.

One pound pressure equals 2.31 feet in height.

One foot in height equals .433 pounds pressure.

The mean pressure of the atmosphere is usually estimated at 14.7 pounds per square inch, so that with a perfect vacuum it will sustain a column of mercury 29.9 inches, or a column of water 33.9 feet high at sea level.

To find the theoretical horse power necessary to elevate water to a given height, multiply the weight of the water elevated per minute by the height in feet and divide the product by 33,000 (an allowance should be made for water friction Another rule commonly used in practice is as follows: Multiply the gallons per minute by the head in feet and divide by 4000.

The resistance of friction in the flow of water through pipes of uniform diameter is independent of the pressure and increases directly as the length and the square of the velocity of the flow and inversely as the diameter of the pipe. With wooden pipes the friction is 1.75 times greater than in metallic,

Doubling the diameter increases the capacity of a pipe four times.

To determine the velocity in feet per minute necessary to discharge a given volume of water in a given time, multiply the number of cubic feet of water by 144 and divide the product by the area of the pipe in inches.

To find the theoretical velocity due to any head, multiply the square root of the head in feet by 8.02.

To determine the area of a required pipe, the volume and velocity of water being given, multiply the number of cubic feet of water by 144 and divide the product by the velocity in feet per minute.

Handy Data on Power Pumping.

Table of Equivalents

Gallons per Minute	Miner's Inches of 9 G. P. M.	Cu. feet per Second	Cubic Feet per Minute	Gallons per Hour	Gallons 24 Hours	Bbls. per Minute 42 Gal. Barrel	Bbls. per Hour 42 Gal. Barrel	Bbls. 24 Hours 42 Gal. Barrel
10	1.11	...	1.3368	600	14,400	.24	14.28	342.8
12	1.33	...	1.6042	720	17,280	.29	17.14	411.4
15	1.66	...	2.0052	900	21,600	.36	21.43	514.3
18	2.	...	2.4063	1,080	25,920	.43	25.71	617.1
20	2.22	...	2.6733	1,200	28,800	.48	28.57	685.7
25	2.78	...	3.342	1,500	36,000	.59	35.71	857.
27	3.	...	3.609	1,620	38,880	.64	38.57	925.
30	3.33	...	4.001	1,800	43,200	.71	42.85	1,028.
35	3.88	...	4.678	2,100	50,400	.83	50.	1,200.
36	4.	...	4.812	2,160	51,840	.86	51.43	1,234.
40	4.4	...	5.348	2,400	57,600	.95	57.14	1,371.
45	5.	.1	6.015	2,700	64,800	1.07	64.28	1,543.
50	5.55	...	6.684	3,000	72,000	1.19	71.43	1,714.
60	6.66	...	8.021	3,600	86,400	1.43	85.71	2,057.
70	7.77	...	9.357	4,200	100,800	1.66	100.	2,400.
75	8.33	...	10.026	4,500	108,000	1.78	107.14	2,570.
80	8.88	...	10.694	4,800	115,200	1.90	114.28	2,742.
90	10.	.2	12.031	5,400	129,600	2.14	128.5	3,085.
100	11.1	...	13.368	6,000	144,000	2.39	142.8	3,428.
125	13.8	...	16.710	7,500	180,000	2.98	178.6	4,286.
135	15.	.3	18.046	8,100	194,400	3.21	192.8	4,628.
150	16.6	...	20.052	9,000	216,000	3.57	214.3	5,143.
175	19.4	...	23.394	10,500	252,000	4.16	250.	6,000.
180	20.	.4	24.062	10,800	259,200	4.28	257.	6,171.
200	22.2	...	26.736	12,000	288,000	4.76	285.7	6,857.
225	25.	.5	30.079	13,500	324,000	5.35	321.4	7,714.
250	27.8	...	33.421	15,000	360,000	5.95	357.1	8,570.
270	30.	.6	36.093	16,200	388,800	6.43	385.7	9,257.
300	33.3	...	40.104	18,000	432,000	7.14	428.5	10,284.
315	35.	...	42.109	18,900	453,600	7.5	450.	10,800.
360	40.	.8	48.125	21,600	518,400	8.57	514.3	12,342.
400	44.4	...	53.472	24,000	576,000	9.52	571.8	13,723.
450	50.	1.	60.158	27,000	648,000	10.7	642.8	15,428.
500	55.5	...	66.842	30,000	720,000	11.9	714.3	17,143.
540	60.	1.2	72.186	32,400	777,600	12.8	771.3	18,512.
600	66.6	...	80.208	36,000	864,000	14.3	857.1	20.570.
630	70.	1.4	84.218	37,800	907,200	15.	900.	21,600.
675	75.	1.5	90.234	40,500	972,000	16.	964.	23,143.
720	80.	1.6	96.25	43,200	1,036,800	17.	1,028.	24,685.
800	88.8	...	106.94	48,000	1,152,000	19.05	1,142.	27,387.
900	100.	2.	120.31	54,000	1,296,000	21.43	1,285.	30,857.
1,000	111.1	...	133.68	60,000	1,440,000	23.8	1,428.	34,284.
1,125	125.	2.5	150.39	67,500	1,620,000	26.78	1,607.	38,571.
1,200	133.3	...	160.42	72,000	1,728,000	28.57	1,714.	41,143.
1,350	150.	3.	180.46	81,000	1,944,000	32.14	1,928.	46,085.
1,500	166.	...	200.52	90,000	2,160,000	35.71	2,142.	51,427.
1,575	175.	3.5	210.54	94,500	2,268,000	37.5	2,250.	54,000.
1,800	200.	4.	240.62	108,000	2,592,000	42.85	2,571.	61,710.
2,000	222.	...	267.36	120,000	2,880,000	47.64	2,857.	68,568.
2,025	225.	4.5	270.70	121,500	2,916,000	48.21	2,892.	69,425.
2,250	250.	...	300.78	135,000	3,240,000	53.57	3,214.	77,143.
2,500	278.	...	334.21	150,000	3,600,000	59.52	3,571.	85,704.
2.700	300.	6.	360.93	162,000	3,880,000	64.3	3,857.	92,572.
3,000	333.	...	401.04	180,000	4,320,000	71.43	4,285.	102,840.

Pressure of Water at Different Heads

Feet Head of Water and Equivalent Pressure

Feet Head	Pounds per Sq. In.	Feet Head	Pounds per Sq. In.	Feet Head	Pounds per Sq. In
1	.43	60	25.99	200	86.62
2	.87	70	30.32	225	97.45
3	1.30	80	34.65	250	108.27
4	1.73	90	38.98	275	119.10
5	2.17	100	43.31	300	129.93
6	2.60	110	47.64	325	140.75
7	3.03	120	51.97	350	151.58
8	3.40	130	56.30	400	173.24
9	3.90	140	60.63	500	216.55
10	4.33	150	64.96	600	259.85
20	8.66	160	69.29	700	303.16
30	12.99	170	73.63	800	346.47
40	17.32	180	77.96	900	389.78
50	21.65	190	82.29	1,000	433.09

Pressure and Equivalent Feet Head of Water

Pounds per Sq. In.	Feet Head	Pounds per Sq. In.	Feet Head	Pounds per Sq.In.	Feet Head
1	2.31	40	92.36	170	392.52
2	4.62	50	115.45	180	415.61
3	6.93	60	138.54	190	438.90
4	9.24	70	161.63	200	461.78
5	11.54	80	184.72	225	519.51
6	13.85	90	207.81	250	577.24
7	16.16	100	230.90	275	643.03
8	18.47	110	253.98	300	692.69
9	20.78	120	277.07	325	750.41
10	23.09	125	288.62	350	808.13
15	34.63	130	300.16	375	865.89
20	46.18	140	323.25	400	922.58
25	57.72	150	346.34	500	1154.48
30	69.27	160	369.43	1,000	2308.

Handy Data on Power Pumping.

Suction Lift of Pumps with Barometric Pressure at Different Altitudes and Equivalent Head of Water

Altitude	Barometric Pressure	Equivalent Head of Water	*Practical Suction Lift of Pumps	Altitude
Sea Level	14.70 lbs. per sq. in.	33.95 ft.	22 ft.	Sea Level
¼ mile (1320 ft.) above sea level	14.02 " "	32.38 "	21 "	¼ mile (1320 ft.) above sea level
½ " (2640 ft.) " " "	13.33 " "	30.79 "	20 "	½ " (2640 ft.) " " "
¾ " (3960 ft.) " " "	12.66 " "	29.24 "	18 "	¾ " (3960 ft.) " " "
1 " (5280 ft.) " " "	12.02 " "	27.76 "	17 "	1 " (5280 ft.) " " "
1¼ " (6600 ft.) " " "	11.42 " "	26.38 "	16 "	1¼ " (6600 ft.) " " "
1½ " (7920 ft.) " " "	10.88 " "	25.13 "	15 "	1½ " (7920 ft.) " " "
2 " (10560 ft.) " " "	9.88 " "	22 82 "	14 "	2 " (10560 ft.) " " "

*Practical Suction lift of pumps is equal to the vertical distance which water is to be lifted plus the head due to friction.

Friction of Water in Pipes

Table showing loss of head in feet due to friction, in various sizes of new, smooth, straight cast iron pipes, per 100 feet, when discharging the following quantities of water:

Gals. per Min.	1 inch		1¼ inches		1½ inches		2 inches		2½ inches		3 inches		4 inches		5 inches		6 inches		8 inches		10 inches		12 inches	
	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.
5	1.86	2.32	1.07	0.60	0.79	0.28	0.49	0.08	0.24	0.06														
10	3.72	8.40	2.14	2.18	1.57	1.02	1.02	0.36	0.65	0.12	0.45	0.05												
15	6.13	18.90	3.92	4.65	2.72	2.25	1.53	0.81	0.98	0.25	0.68	0.11												
20	7.44	30.10	4.29	7.90	3.15	3.70	2.04	1.29	1.31	0.43	0.91	0.18												
25	9.30	45.50	5.36	11.90	4.56	5.60	2.60	1.96	1.63	0.66	1.13	0.27												
30	11.15	64.00	6.43	16.90	4.72	7.80	3.06	2.73	1.96	0.92	1.36	0.38												
35	13.02	85.00	7.51	22.30	5.51	10.30	3.57	3.66	2.29	1.23	1.59	0.51												
40	14.88	109.00	8.58	28.50	6.30	13.30	4.05	4.68	2.62	1.57	1.82	0.65	1.02	0.16										
45			9.68	35.20	7.08	16.60	4.60	5.80	2.95	1.97	2.02	0.80	1.17	0.20										
50			10.72	43.20	7.87	20.20	5.11	7.10	3.30	2.38	2.27	0.98	1.28	0.24										
70					11.02	37.60	7.15	13.20	4.60	4.42	3.18	1.83	1.79	0.45	1.14	0.15								
100					15.74	73.00	10.20	25.60	6.54	8.60	4.54	3.52	2.55	0.88	1.63	0.29	1.14	0.10						
120							12.25	36.00	7.84	12.00	5.45	4.97	3.06	1.22	1.96	0.41	1.42	0.18						
150							15.30	54.00	9.80	18.72	6.80	7.72	3.84	1.82	2.45	0.63	1.71	0.23						
175									11.43	23.70	7.92	9.75	4.45	2.40	2.86	0.84	2.00	0.34						
200									13.07	30.90	9.08	12.80	5.11	3.12	3.27	1.06	2.28	0.44						
250											11.28	19.70	6.40	4.80	4.08	1.60	2.80	0.66	1.60	0.16				
270											12.45	22.70	6.90	5.50	4.42	1.86	3.03	0.81	1.70	0.18				
300											13.62	27.10	7.66	6.70	4.90	2.25	3.40	0.92	1.90	0.26				
350													8.90	8.80	5.72	2.99	3.98	1.21	2.20	0.29				
400													10.20	11.30	6.54	3.81	4.54	1.58	2.60	0.40				
450													11.50	14.10	7.35	4.75	5.12	1.96	2.92	0.46	1.80	0.15		
470													12.16	16.00	7.78	5.30	5.49	2.23	3.07	0.55	1.92	0.17		
500													12.77	17.20	8.17	5 80	5.60	2.33	3.20	0.58	2.00	0.19	1.40	0.08
750															12.26	12.30	8.40	4.87	4.80	1.24	3.00	0.39	2.10	0.17
1050																	12.57	10.30	7.04	2.51	4.40	0.83	3.08	0.34
1250																	14.10	13.00	8.00	3.18	5.00	1.03	3.50	0.43
1500																			9.60	4.48	6.10	1.49	4.20	0.61
2000																			12.70	7.65	8.10	2.50	5.60	1.02
2500																					10.10	3.81	7.00	1.56
3000																					12.10	5.30	8.40	2.42
3500																					14.10	7.20	9.80	2.80
4000																							11.35	3.80
4200																							11.93	4.50
4500																							12.78	4.82
5000																							14.20	5.82

When pipe is slightly rough, add 15%. When very rough add 30%
Vel.—Velocity in feet per second.
Fric.—Friction head in feet.

Handy Data on Power Pumping.

Friction of Water in Pipes (Continued)

Table showing loss of head in feet, due to friction in various sizes of smooth 90° elbows

Gals per Min	1 inch		1¼ inches		1½ inches		2 inches		2½ inches		3 inches		4 inches		5 inches		6 inches		8 inches		10 inches		12 inches	
	Vel	Fric	Vel	Fric	Vel	Fric	Vel	Fric	Vel	Fric	Vel	Fric	Vel	Fric.	Vel.	Fric.	Vel.	Fric.	Vel.	Fric.	Vel	Fric.	Vel.	Fric.
5	2.04	0.06	1 30	0.14																				
10	4 08	0.22	2.60	0.21																				
15	6.12	0.49	3.90	0.29	2.73	0 09																		
20	8.16	0.87	5.20	0.52	3.64	0.16																		
25	10.20	1.35	6.50	0.80	4.55	0.25	2 60	0.09																
30	12.24	1.95	7.80	1.15	5.46	0.36	3.06	0.13																
35	14.28	2.65	9.10	1.60	6.37	0.50	3.57	0.18	2.29	0.09														
40	16.32	3.46	10.40	2.05	7.28	0.64	4.05	0.23	2.62	0 11														
45			11.70	2.70	8.19	0.81	4.60	0.29	2 95	0 14	2.02	0.06												
50					9.10	0.99	5.11	0.35	3.30	0.18	2.27	0.08												
70					12.74	1.98	7 15	0.70	4.60	0.34	3.18	0.19	1.79	0.05										
100							10.20	1.41	6.54	0.74	4.54	0.29	2.55	0.10										
120							12.25	2.24	7.84	1.17	5.45	0.05	3.06	0.15	1.96	0.06								
150							15.30	3.20	9.80	1.58	6.80	0.66	3.84	0.22	2.45	0.09								
175									11.43	2.16	7.92	0.90	4.45	0.30	2.86	0.12	2.00	0.06						
200									13 07	2.96	9.08	1 18	5.11	0.40	3.27	0.16	2.28	0.07						
250											11.28	1.84	6.40	0.62	4.08	0.25	2.80	0.12	1.60	0.04				
270											12.45	2.35	6.90	0.70	4.42	0.27	3.03	0.14	1.70	0.04				
300											13.62	2.63	7 66	0.89	4.90	0.36	3.40	0.18	1.90	0.06				
350													8.90	1.24	5.72	0.50	3.98	0.24	2.20	0.09				
400													10.20	1.59	6.54	0.63	4.54	0.29	2.60	0.10				
450													11.50	2.01	7.35	0.81	5.12	0.39	2.92	0.13	1.80	0.05		
470													12.16	2.26	7.78	0.90	5.49	0.46	3.07	0.14	1.92	0.06		
500													12 77	2.47	8.17	1.01	5.60	0.48	3.20	0.16	2.00	0.06	1.40	0.04
750															12 26	2.24	8.40	1.09	4.80	0.36	3.00	0.15	2.10	0.07
1050																	12.57	2.41	7.04	0.76	4.40	0.29	3.08	0.14
1250																	14 10	3.02	8.00	1.00	5.00	0.40	3.50	0.20
1500																			9.60	1.44	6.10	0.58	4.20	0.29
2000																			12.70	2.44	8.10	1.01	5.60	0.47
2500																			15.90	3.68	10.10	1.57	7.00	0.75
3000																					12.10	2.25	8.40	1.08
3500																					14.10	3.05	9.80	1.47
4000																							11.35	1.92
4200																							11.93	2.18
4500																							12.78	2.43
5000																							14.20	3.01

When pipe is slightly rough add 15%. When very rough add 30%.
Vel:—Velocity in feet per second.
Fric.—Friction head in feet.
Table shows loss for one elbow, and is based on Weisbach's Formula for short radius bends.

Discharge of Water

Given in cubic feet per minute, the area of the stream being one square inch

Head	Discharge	Head	Discharge	Head	Discharge	Head	Discharge	Head	Discharge
1	3.34	31	18.60	61	26.08	91	31.86	121	36.73
2	4.73	32	18.90	62	26.29	92	32.04	122	36.88
3	5.79	33	19.20	63	26.49	93	32.20	123	37.03
4	6.68	34	19.49	64	26.72	94	32.38	124	37.18
5	7.47	35	19.77	65	26.92	95	32.55	125	37.33
6	8.18	36	20.05	66	27.13	96	32.72	126	37.48
7	8.84	37	20.33	67	27.33	97	32.89	127	37.63
8	9.45	38	20.60	68	27.54	98	33.06	128	37.78
9	10.02	39	20.87	69	27.74	99	33.23	129	37.93
10	10.51	40	21.13	70	27.94	100	33.40	130	38.07
11	11.08	41	21.38	71	28.14	101	33.57	131	38.22
12	11.57	42	21.64	72	28.34	102	33.73	132	38.37
13	12.05	43	21.90	73	28.53	103	33.90	133	38.51
14	12.50	44	22.15	74	28.73	104	34.06	134	38.66
15	12.94	45	22.40	75	28.93	105	34.22	135	38.80
16	13.37	46	22.65	76	29.11	106	34.39	136	38.95
17	13.78	47	22.89	77	29.30	107	34.55	137	39.09
18	14.18	48	23.14	78	29.49	108	34.71	138	39.23
19	14.57	49	23.38	79	29.68	109	34.87	139	39.37
20	14.95	50	23.61	80	29.87	110	35.03	140	39.51
21	15.31	51	23.85	81	30.06	111	35.19	141	39.65
22	15.67	52	24.08	82	30.24	112	35.35	142	39.79
23	16.02	53	24.31	83	30.42	113	35.50	143	39.93
24	16.37	54	24.54	84	30.61	114	35.66	144	40.07
25	16.71	55	24.76	85	30.79	115	35.82	145	40.21
26	17.04	56	24.99	86	30.97	116	35.97	146	40.35
27	17.36	57	25.21	87	31.15	117	36.12	147	40.49
28	17.68	58	25.43	88	31.33	118	36.28	148	40.63
29	17.99	59	25.65	89	31.50	119	36.43	149	40.77
30	18.30	60	25.87	90	31.68	120	36.58	150	40.90

Handy Data on Power Pumping.

Theoretical Discharge of Nozzles in U. S. Gallons Per Minute

Head		Veloc'y of Disch. Feet per Sec	Diameter of Nozzle in Inches												
Lbs.	Feet		1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
10	23.1	38.6	0.37	1.48	3.32	5.91	13.3	23.6	36.9	53.1	72.4	94.5	120	148	179
15	34.6	47.25	0.45	1.81	4.06	7.24	16.3	28.9	45.2	65.0	88.5	116.	147	181	219
20	46.2	54.55	0.52	2.09	4.69	8.35	18.8	33.4	52.2	75.1	102.	134.	169	209	253
25	57.7	61.0	0.58	2.34	5.25	9.34	21.0	37.3	58.3	84.0	114.	149.	189	234	283
30	69.3	66.85	0.64	2.56	5.75	10.2	23.0	40.9	63.9	92.0	125.	164.	207	256	309
35	80.8	72.2	0.69	2.77	6.21	11.1	24.8	44.2	69.0	99.5	135.	177.	224	277	334
40	92.4	77.2	0.74	2.96	6.64	11.8	26.6	47.3	73.8	106.	145.	189.	239	296	357
45	103.9	81.8	0.78	3.13	7.03	12.5	28.2	50.1	78.2	113.	153.	200.	253	313	379
50	115.5	86.25	0.83	3.30	7.41	13.2	29.7	52.8	82.5	119.	162.	211.	267	330	399
55	127.0	90.4	0.87	3.46	7.77	13.8	31.1	55.3	86.4	125.	169.	221.	280	346	418
60	138.6	94.5	0.90	3.62	8.12	14.5	32.5	57.8	90.4	130.	177.	231.	293	362	438
65	150.1	98.3	0.94	3.77	8.45	15.1	33.8	60.2	94.0	136.	184.	241.	305	376	455
70	161.7	102.1	0.98	3.91	8.78	15.7	35.2	62.5	97.7	141.	191.	250.	317	391	473
75	173.2	105.7	1.01	4.05	9.08	16.2	36.4	64.7	101.	146.	198.	259.	327	404	489
80	184.8	109.1	1.05	4.18	9.39	16.7	37.6	66.8	104.	150.	205.	267.	338	418	505
85	196.3	112.5	1.08	4.31	9.67	17.3	38.8	68.9	108.	155.	211.	276.	349	431	521
90	207.9	115.8	1.11	4.43	9.95	17.7	39.9	70.8	111.	160.	217.	284.	359	443	536
95	219.4	119.0	1.14	4.56	10.2	18.2	41.0	72.8	114.	164.	223.	292.	369	456	551
100	230.9	122.0	1.17	4.67	10.5	18.7	42.1	74.7	117.	168.	229.	299.	378	467	565
105	242.4	125.0	1.20	4.79	10.8	19.2	43.1	76.5	120.	172.	234.	306.	388	479	579
110	254.0	128.0	1.23	4.90	11.0	19.6	44.1	78.4	122.	176.	240.	314.	397	490	593
115	265.5	130.9	1.25	5.01	11.2	20.0	45.1	80.1	125.	180.	245.	320.	406	501	606
120	277.1	133.7	1.28	5.12	11.5	20.5	46.0	81.8	128.	184.	251.	327.	414	512	619
125	288.6	136.4	1.31	5.22	11.7	20.9	47.0	83.5	130.	188.	256.	334.	423	522	632
130	300.2	139.1	1.33	5.33	12.0	21.3	48.0	85.2	133.	192.	261.	341.	432	533	645
135	311.7	141.8	1.36	5.43	12.2	21.7	48.9	86.7	136.	195.	266.	347.	439	543	656
140	323.3	144.3	1.38	5.53	12.4	22.1	49.8	88.4	138.	199.	271.	354.	448	553	668
145	334.8	146.9	1.41	5.62	12.6	22.5	50.6	89.9	140.	202.	275.	360.	455	562	680
150	346.4	149.5	1.43	5.72	12.9	22.9	51.5	91.5	143.	206.	280.	366.	463	572	692
175	404.1	161.4	1.55	6.18	13.9	24.7	55.6	98.8	154.	222.	302.	395.	500	618	747
200	461.9	172.6	1.65	6.61	14.8	26.4	59.5	106.	165.	238.	323.	423.	535	660	799
250	577.4	193.0	1.85	7.39	16.6	29.6	66.5	118.	185.	266.	362.	473.	598	739	894
300	692.8	211.2	2.02	8.08	18.2	32.4	72.8	129.	202.	291.	396.	517.	655	808	977

Head		Veloc'y of Disch. Feet per Sec.	Diameter of Nozzle in Inches												
Lbs.	Feet		1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/2	4	4 1/2	5	5 1/2	6
10	23.1	38.6	213	289	378	479	591	714	851	1158	1510	1915	2365	2855	3405
15	34.6	47.25	260	354	463	585	723	874	1041	1418	1850	2345	2890	3490	4165
20	46.2	54.55	301	409	535	676	835	1009	1203	1638	2135	2710	3340	4040	4810
25	57.7	61.0	336	458	598	756	934	1128	1345	1830	2385	3025	3730	4510	5380
30	69.3	66.85	368	501	655	828	1023	1236	1473	2005	2615	3315	4090	4940	5895
35	80.8	72.2	398	541	708	895	1106	1335	1591	2168	2825	3580	4415	5340	6370
40	92.4	77.2	425	578	756	957	1182	1428	1701	2315	3020	3830	4725	5710	6810
45	103.9	81.8	451	613	801	1015	1252	1512	1802	2455	3200	4055	5000	6050	7210
50	115.5	86.25	475	647	845	1070	1320	1595	1900	2590	3375	4275	5280	6380	7600
55	127.0	90.4	498	678	886	1121	1385	1671	1991	2710	3540	4480	5530	6690	7970
60	138.6	94.5	521	708	926	1172	1447	1748	2085	2835	3700	4685	5790	6980	8330
65	150.1	98.3	542	737	964	1220	1506	1819	2165	2950	3850	4875	6020	7270	8670
70	161.7	102.1	563	765	1001	1267	1565	1888	2250	3065	4000	5060	6250	7560	9000
75	173.2	105.7	582	792	1037	1310	1619	1955	2330	3170	4135	5240	6475	7820	9320
80	184.8	109.1	602	818	1070	1354	1672	2020	2405	3280	4270	5410	6690	8080	9630
85	196.3	112.5	620	844	1103	1395	1723	2080	2480	3375	4400	5575	6890	8320	9920
90	207.9	115.8	638	868	1136	1436	1773	2140	2550	3475	4530	5740	7090	8560	10210
95	219.4	119.0	656	892	1168	1476	1824	2200	2625	3570	4655	5900	7290	8800	10500
100	230.9	122.0	672	915	1196	1512	1870	2255	2690	3660	4775	6050	7470	9030	10770
105	242.4	125.0	689	937	1226	1550	1916	2312	2755	3750	4890	6200	7650	9250	11020
110	254.0	128.0	705	960	1255	1588	1961	2366	2820	3840	5010	6350	7840	9470	11300
115	265.5	130.9	720	980	1282	1621	2005	2420	2885	3930	5120	6490	8010	9680	11550
120	277.1	133.7	736	1002	1310	1659	2050	2470	2945	4015	5225	6630	8180	9900	11800
125	288.6	136.4	751	1022	1338	1690	2090	2520	3005	4090	5340	6760	8350	10100	12030
130	300.2	139.1	767	1043	1365	1726	2132	2575	3070	4175	5450	6900	8530	10300	12290
135	311.7	141.8	780	1063	1390	1759	2173	2620	3125	4250	5550	7030	8680	10490	12510
140	323.3	144.3	795	1082	1415	1790	2212	2670	3180	4330	5650	7160	8850	10690	12730
145	334.8	146.9	809	1100	1440	1820	2250	2715	3235	4410	5740	7280	8990	10880	12960
150	346.4	149.5	824	1120	1466	1853	2290	2760	3295	4485	5850	7410	9150	11070	13200
175	404.1	161.4	890	1210	1582	2000	2473	2985	3560	4840	6310	8000	9890	11940	14250
200	461.9	172.6	950	1294	1691	2140	2645	3190	3800	5175	6750	8550	10580	12770	15220
250	577.4	193.0	1063	1447	1891	2392	2955	3570	4250	5795	7550	9570	11820	14290	17020
300	692.8	211 2	1163	1582	2070	2615	3235	3900	4650	6330	8260	10480	12940	15620	18610

NOTE: The actual quantities will vary from these figures, the amount of variation depending upon the shape of nozzle and size of pipe at the point where the pressure is determined.

Handy Data on Power Pumping

Table of Effective Fire Streams

JOHN R. FREEMAN, C. E.

Using 100 feet of 2½ inch ordinary best quality rubber-lined hose between nozzle and hydrant, or Pump

Smooth Nozzle, Size	3/4-Inch						7/8-Inch						1-Inch					
Pressure at Hydrant, lbs.	32	43	54	65	75	86	34	46	57	69	80	91	37	50	62	75	87	100
Pressure at Nozzle, lbs.	30	40	50	60	70	80	30	40	50	60	70	80	30	40	50	60	70	80
*Verticle Height, feet of Effective Stream	48	60	67	72	76	79	49	62	71	77	81	85	51	64	73	79	85	89
*Horizontal Distance, feet, Effective Stream	37	44	50	54	58	62	42	49	55	61	66	70	47	55	61	67	72	76
Gallons Discharged per Minute	90	104	116	127	137	147	123	142	159	174	188	201	161	186	208	228	246	263

Smooth Nozzle Size	1 1/8-Inch						1 1/4-Inch						1 3/8-Inch					
Pressure at Hydrant, lbs.	42	56	70	84	98	112	49	65	81	97	113	129	58	77	96	116	135	154
Pressure at Nozzle, lbs.	30	40	50	60	70	80	30	40	50	60	70	80	30	40	50	60	70	80
*Vertical Height, feet of Effective Stream	52	65	75	83	88	92	53	67	77	85	91	95	55	69	79	87	92	97
*Horizontal Distance, feet, Effective Stream	50	59	66	72	77	81	54	63	70	76	81	85	56	66	73	79	84	88
Gallons Discharged per Minute	206	238	266	291	314	336	256	296	331	363	392	419	315	363	406	445	480	514

Two hundred and fifty gallons per minute is a good standard fire stream with 80 pounds pressure at the hydrant.

*Spray or drops will go from 22 per cent. to 56 per cent. higher, and from 120 per cent. to 150 per cent. farther horizontally, but figures given in table are for "*Effective*" fire streams that will make a black mark where they hit.

Areas of Circles—Advancing by Eighths

Diameter	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8	Diameter
0	.0	.1022	.0490	.1104	1963	.3068	.4417	.6013	0
1	.7854	.9940	1.227	1.484	1.767	2.073	2.405	2.761	1
2	3.141	3.546	3.976	4.430	4.908	5.411	5.939	6.491	2
3	7.068	7.669	8.295	8.946	9.621	10.32	11.04	11.97	3
4	12.56	13.36	14.18	15.03	15.90	16.80	17.72	18.66	4
5	19.63	20.62	21.64	22.69	23.75	24.85	25.96	27.10	5
6	28.27	29.46	30.67	31.91	33.18	34.47	35.78	37.12	6
7	38.48	39.87	41.28	42.71	44.17	45.66	47.17	48.70	7
8	50.26	51.84	53.45	55.08	56.74	58.62	60.13	61.86	8
9	63.61	65.39	67.20	69.02	70.88	72.55	74.66	76.58	9
10	78.54	80.51	82.51	84.54	86.59	88.66	90.76	92.88	10
11	95.03	97.20	99.40	101.6	103.8	106.1	108.4	110.7	11
12	113.0	115.4	117.8	120.2	122.7	125.1	127.6	130.1	12
13	132.7	135.2	137.8	140.5	143.1	145.8	148.4	151.2	13
14	153.9	156.6	159.4	162.2	165.1	167.9	170.8	173.7	14
15	176.7	179.6	182.6	185.6	188.6	191.7	194.8	197.9	15
16	201.0	204.2	207.3	210.5	213.8	217.0	220.3	223.6	16
17	226.9	230.3	233.7	237.1	240.5	243.9	247.4	250.9	17
18	254.4	258.0	261.5	265.1	268.8	272.4	276.1	279.8	18
19	283.5	287.2	291.0	294.8	298.6	302.4	306.2	310.2	19
20	314.1	318.1	322.0	326.0	330.0	334.1	338.1	342.2	20
21	346.3	350.4	354.6	358.8	363.0	367.2	371.5	375.8	21
22	380.1	384.4	388.8	393.2	397.6	402.0	406.4	410.9	22
23	415.4	420.0	424.5	429.1	433.7	438.3	443.0	447.6	23
24	452.3	457.1	461.8	466.6	471.4	476.2	481.1	485.9	24
25	490.8	495.7	500.7	505.7	510.7	515.7	520.7	525.8	25
26	530.9	536.0	541.1	546.3	551.5	556.7	562.0	567.2	26
27	572.5	577.8	583.2	588.5	593.9	599.3	604.8	610.2	27
28	615.7	621.2	626.7	632.3	637.9	643.5	649.1	654.8	28
29	660.5	666.2	671.9	677.7	683.4	689.2	695.1	700.9	29
30	706.8	712.7	718.6	724.6	730.6	736.6	742.6	748.6	30
31	754.8	760.9	767.0	773.1	779.3	785.5	791.7	798.0	31
32	804.2	810.5	816.9	823.3	829.6	836.0	842.4	848.8	32
33	855.3	861.8	868.3	874.8	881.4	888.0	894.6	901.3	33
34	907.9	914.6	921.3	928.1	934.8	941.6	948.4	955.3	34
35	962.1	969.0	975.9	982.8	989.8	996.8	1003.8	1010.8	35
36	1017.9	1025.0	1032.1	1039.2	1046.4	1053.5	1060.7	1068.0	36
37	1075.2	1082.5	1089.8	1097.1	1104.5	1111.8	1119.2	1126.7	37
38	1134.1	1141.6	1149.1	1156.6	1164.2	1171.7	1179.3	1186.9	38
39	1194.6	1202.3	1210.0	1217.7	1225.4	1233.2	1241.0	1248.8	39
40	1256.6	1264.5	1272.4	1280.3	1288.3	1296.2	1304.2	1312.2	40
41	1320.3	1328.3	1336.4	1344.5	1352.7	1360.8	1369.0	1377.2	41
42	1385.4	1393.7	1402.0	1410.3	1418.6	1427.0	1435.4	1443.8	42
43	1452.2	1460.7	1469.1	1477.6	1486.2	1494.7	1503.3	1511.9	43
44	1520.5	1529.2	1537.9	1546.6	1555.3	1564.0	1572.8	1581.6	44
45	1590.4	1599.3	1608.2	1617.0	1626.9	1643.9	1643.9	1652.9	45
46	1661.9	1671.0	1680.0	1689.1	1698.2	1707.4	1716.5	1725.7	46
47	1734.9	1744.2	1753.5	1762.7	1772.1	1781.4	1790.8	1800.1	47
48	1809.6	1819.0	1828.5	1837.9	1847.5	1857.0	1866.6	1876.1	48
49	1885.7	1895.4	1905.0	1914.7	1924.4	1934.2	1943.9	1953.7	49
50	1963.5	1973.3	1983.2	1993.1	2003.0	2012.9	2022.8	2032.8	50

Information required for making estimates on Water Supply Outfits, Pumps, etc.

1. What and where is source of water supply?
2. If well, give depth and diameter?
3. What is the distance from the ground to the surface of the water?
4. Is the water level lowered by continuous pumping?
5. Have you any pumps, engines or other power you would like to use with our system? Give complete description and maker's name?
6. What power would you like to drive pump?
7. How many gallons of water do you want per hour?
8. Do you use elevated storage tank?
9. Do you use pneumatic tank?
10. Capacity?
11. If elevated tank, what is height above ground?
12. Do you use hose lines only?
13. How many houses have you?
14. What is size of each house?
15. Do you need water for other purposes in addition to that required for greenhouses?
16. If so, what?
17. Do you want figures on complete outfit?
18. Or, do you want engine only?
19. Or, do you want pump only?
20. Or, do you want engine and pump only, without tank, pipe or fittings?
21. Do you want pneumatic system?
22. Give list of material on hand if any?

IMPORTANT—Make a rough sketch showing location of well, houses, garden, etc., giving distances- whether well platform is above or below level of houses, and how much? Give compass points and also show your idea of installing system.

Information required for making Estimates on Boilers and Piping Systems for Steam or Hot Water Heating

(*Do not cut this page. Send for Blanks.*)

House	Width, Feet	Length, Feet	Height at Eaves	Temperature Required at Night	What Kind of Stock Will be Grown in Each House
A	.....	.....	.....	.....	.....
B	.....	.....	.....	.....	.....
C	.....	.....	.....	.....	.....
D	.....	.....	.....	.....	.....
E	.....	.....	.....	.....	.....
F	.....	.....	.....	.....	.....
G	.....	.....	.....	.....	.....
H	.....	.....	.....	.....	.....
I	.....	.....	.....	.....	.....

1. Do you want steam or hot water heating?
2. Do you want complete system or boiler only?
3. Are walls, wood or concrete?
4. Are houses, exposed to strong winds?
5. Is land level or on a grade?
6. Which way does it fall?
7. How much is the fall?
8. Is boiler to be at lowest point?
9. Can you set boiler in a pit?
10. How deep can you make boiler pit?
11. Have you a chimney?
12. What size and how high is chimney?
13. How many hours do you want to keep fire without attention?
14. Are beds solid, on ground or on legs?
15. How soon will you need apparatus?

Make a rough sketch showing houses. Show location of boiler and chimney on the sketch, also show points of the compass. A sketch will be of much help. It need not be drawn to scale.

Moninger Boilers.

THE
Moninger Boiler

Our boiler we think is the greatest and best greenhouse boiler ever made. We are so enthusiastic about it and we believe in it so firmly that we can't understand why anyone should use any other make. Won't you read the following pages through carefully and let us tell you something about this remarkable invention.

Buying a boiler is a good deal like buying a horse, for you don't know whether it is good or not until you give it a trial. It is a safe plan when you want a new boiler to get it from the people you have the most confidence in.

You wouldn't go to a hardware store to buy potatoes, so why should you go to a firm making locomotives or stoves to get a greenhouse boiler.

Every day in the year we come in contact with greenhouse work and greenhouse heating while most boiler makers devote their time entirely to residence or power work. You must get a greenhouse boiler made for greenhouse work if you expect perfect results.

We have been making greenhouse material as an organized company since 1868, which is a good long time to be constantly hammering at one thing, and we come pretty near knowing the difference between a good boiler and a bad one. We tell good and bad boilers about the same way you would tell good and bad eggs. A good boiler is a mighty nice thing to have, but a bad one is worse than none.

We are going to try and show you in the following pages why our boiler is not only a good boiler but the best and most wonderful boiler on the market today, for greenhouse heating. We understand fully what the word wonderful means and we say it with the full meaning, for our boiler is really a very wonderful boiler when you come to know it as we do.

Moninger Boilers.

Hot Water Boiler Complete Ready for Connections to System.

This boiler was first put on the market in the summer of 1909 and after two winters elapsed it had achieved the remarkable record of heating two million square feet of glass. This is something that has never been done before by any boiler either cast iron or steel. In one winter alone, 250 boilers were put in for greenhouse heating and we don't believe there is a boiler maker in the United States that can stand up and truthfully say he ever put in 250 boilers for greenhouse heating in a year.

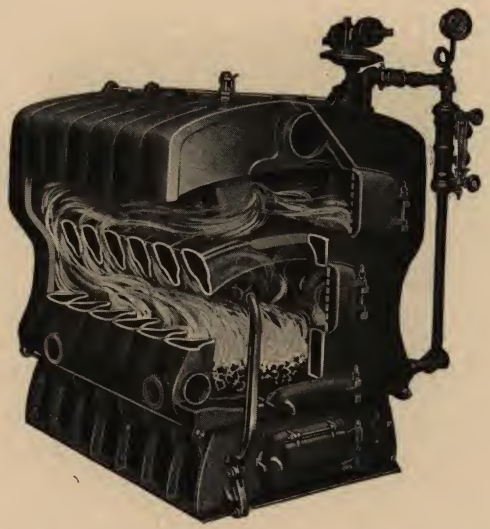
There are several reasons why the boiler has been adopted so rapidly and as explained before we are going to show you some of the reasons.

The first thing to look for in a boiler is the fire travel. Any old boiler can send the heat up the chimney, but it takes a good one to give the right draft, hold the heat until it can be used, and have the proper amount of space to give perfect combustion.

Our boiler has a fire travel three times the boiler length and twice across its width. This extra long fire travel when connected to a chimney of the proper size makes an ideal combination and it's a hard one to beat for heating. But there is more to fire travel than mere length and width. It depends on how the fire travel is accomplished and over what surfaces it passes.

Fire that travels over thick water columns and through small smoke passages cannot be as efficient as fire that passes over thin water columns in sufficient volume to give perfect combustion and heat.

Moninger Boilers.



Steam Trimmings in place—Made in Two Styles.

There are no 101 small nooks and corners in our boiler designed to convert smoke and gases into a thousand different fantastic shapes. We don't claim to use 999,999 heat units out of every million and then make enough paint out of the smoke to pay for the coal.

Some of our friends claim all of this and a few other things, but you can generally set it down as hard fact that when your smoke pipe leading to the chimney is cold your boiler is doing poor work and you are not getting all you should out of your coal pile.

The fire travel must be so designed that perfect combustion will take place. The gases given off by the coal must have room in which to expand and to ignite with the air drawn in. For every little particle or unit of gas given off by the coal there are thirteen particles of air needed. Each little particle of gas must find its thirteen affinities in the air to get perfect combustion and in order to get these particles together and have them burn when united you must have sufficient room, not only directly above the fire, but in the smoke passages in other parts of the boiler together with a temperature high enough and even enough to cause combustion.

Where the fire must travel through a long, winding, narrow passage, the little particles of air and gas have no chance to get together and instead of heated gas you have nothing but smoke. This smoke contains all the necessary parts to make heat, but the temperature in the passage is too low on account of velocity of travel and the smallness of passage

Moninger Boilers.

Notice the Deep Fire Pot and Thin Extended Waterways.

and there is not sufficient room to expand and burn. Finally when contents of all of these small smoke flues get together in the smoke pipe they rush into the chimney. There they have room to expand and if temperature is right they ignite and burn. This turns your chimney into a furnace and the good hard dollars that you paid for coal go sailing off into the air.

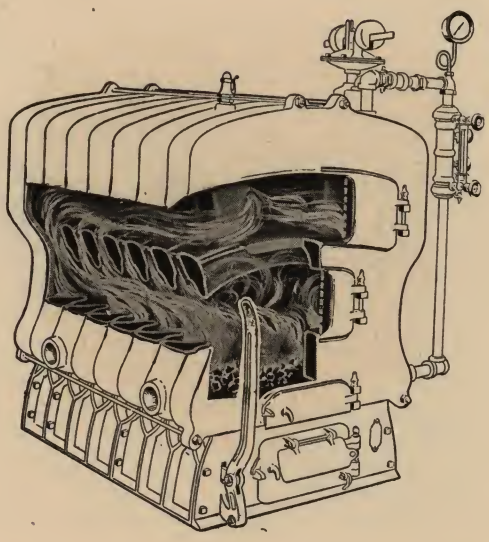
It's a difficult thing to look through a brick chimney and see what is going on, but if you have a boiler with a large number of tubes or smoke flues and if when you open the flue doors on this boiler you see nothing but black and gray smoke moving around in a countless number of forms and shapes, you can almost bet money that you have a nice fire burning in the chimney somewhere between the top and bottom. You can put your hand on the smoke pipe—yes—but a piece of iron would probably melt in the chimney.

The fire travel is important but it is just as bad to have it too long and crooked as it is to have it too short and straight. The fire travel must be a perfect fire travel and there are no 275 different right ways of putting fire travel into a boiler.

There is only one right principle and, we believe, our fire travel is the *final* and *correct* solution of this principle.

We said before, this boiler was first put out in 1909, so it is practically new, but after being two years on the market, three of the largest boiler

Moninger Boilers.



The Fire Travels Three Times the Length and Twice Across.

manufacturers changed their fire travel and made it as near as they could like ours.

Another thing about *fire travel* is it *must be flexible.* By flexible we mean it must be made so it can be adapted to nearly all kinds of chimneys.

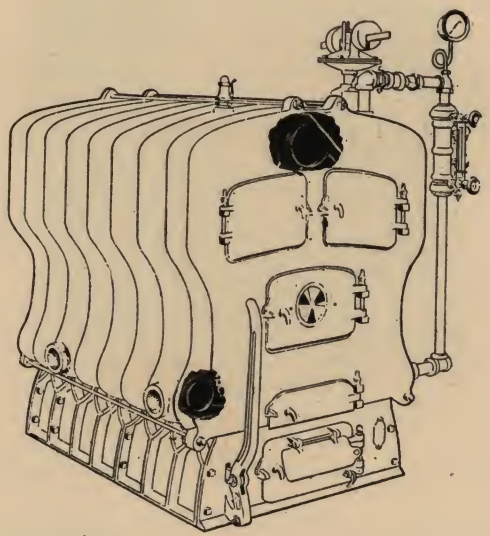
Probably your chimney has too much velocity and not enough volume or it has too much volume and not enough velocity. Velocity refers to the speed with which the air travels and the volume to the quantity of air.

You may have plenty of volume but not enough speed or velocity to draw the air through the draft door up through the grates over the fire, through the flues and out and up the chimney, or you may have plenty of velocity to draw the air at a high speed through the boiler and chimney, but not sufficient volume to furnish air enough to unite with the gas thrown off by the coal.

Too much volume and not enough velocity makes a poor draft and the fire will not burn briskly but smoulders and smokes. Too much velocity and not enough volume makes a good brisk fire, but all the heated gases are carried off into the air.

As stated, though, the fire travel in a boiler has much to do with this. Our fire travel is so arranged it can be made longer or shorter according to the chimney. If your chimney is one of the kind with too much volume and not enough velocity, the fire travel can be made so it

Moninger Boilers.



Every Section is Put Together With Cast Iron Push Nipples.

extends only twice the length of the boiler and once across. If your chimney is one of the kind that has too much velocity and not enough volume, the fire travel can be extended to the full distance of three times the length of the boiler and twice across so the air will be held in the boiler long enough for it to unite with the gases and be converted into heat.

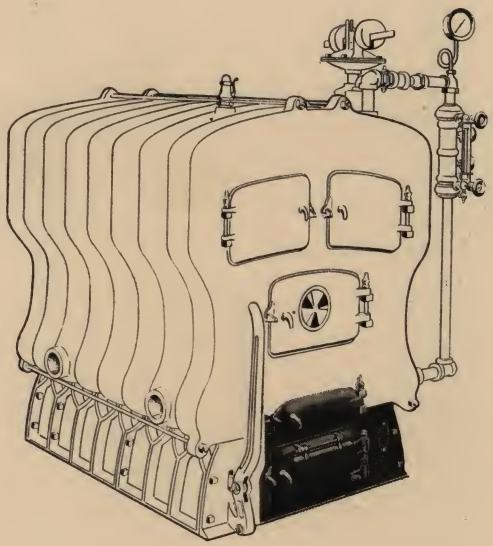
Of course no fire travel can be made that will take care of extreme conditions, but it's a mighty handy thing to have a boiler that can be adjusted and adapted to your chimney, for you can't get the value out of your coal unless the boiler and the chimney both work together.

No other boiler that we know of has this feature and as this is covered by strong patents in our boilers, we hardly think you will find another boiler for some years to come that has a flexible fire travel.

The manner in which the boiler is put together is probably the most important thing next to the fire travel.

Formerly the Sectional Boilers were connected by means of screwed headers, flanges, or asbestos gaskets, but nowadays no up-to-date boiler maker uses anything except the cast iron push nipple. These nipples are tapered very accurately to the thousandth part of an inch and are made to fit perfectly into the port openings in the sections. When the

Moninger Boilers.



Clinker Door Level with the Grates. Large Ash Pit Door and Check.

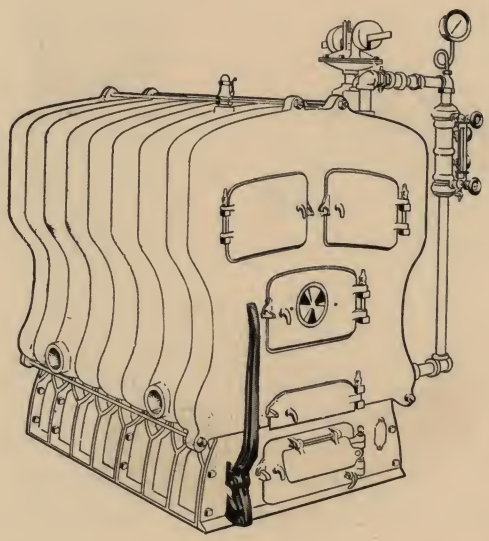
sections are drawn together you have an iron to iron joint that will never leak and will last as long as the boiler stands.

With the old method of flanges, packed joints, etc., you always had a leak somewhere with no possible chance to fix it. As soon as one was fixed two more started and so it kept on until the owner was disgusted and condemned sectional boilers of all makes, types, and sizes. It is really a pleasure to put the boiler together with the push nipples, and after you have it set up you are sure it is going to stay. If you don't buy your boiler of us be sure you get one with cast iron push nipples.

Clinkers and ashes are one of the things you have to contend with when running a boiler. To remove clinkers you should have a clinker door large enough to permit of easy slicing of the fire with a slice bar. This door in our boiler opens even with the grate and the lower part of the section above the base is cut away so your bar gets right at the bottom of things.

Ashes must be removed often enough to keep grate bars from warping and melting. You need a good big door on the ash pit so this unpleasant job can be done with the least amount of trouble. We have provided a door just the right size and with the boiler will furnish you a good hoe

Moninger Boilers.



All Grates Operated From the Front with Lever Handle.

to do the work with. More grate bars are burned out on account of ashes than for any other reason, so keep the ash pit clean and never let the ashes pile up under the grates.

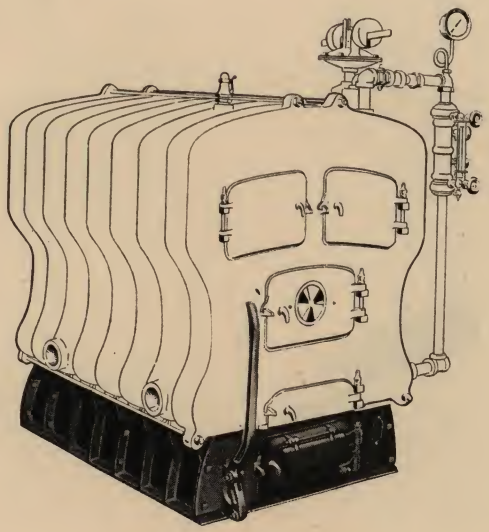
It is a good plan to make the ash pit deep so you have plenty of room for the ashes. Boilers are generally set on a level cement foundation, but a better plan is to build a brick foundation just the size of the base about 6 inches below the floor. You will find complete information about this, together with drawing on pages 219 and 220. You will find this a good scheme and it may save you a few dollars in grate bars.

Our grate bars are designed to break up the clinkers in the fire pot so you get only the fine ashes down in the ash pit. The grates have round tops which operate on the rocking principle and grind together in such a way the clinkers are crushed into small pieces.

It has been established and proven beyond all doubt that a Sectional Boiler to give ideal service must be made in two general divisions, one for carrying the water and supplying heat, and the other for carrying the fire and for the ash pit.

The base, on which all the sections set, is made entirely separate, carries all of the grate bars, lever handles for shaking the grates, draft doors and forms the ash pit. This part of the boiler has nothing to do with the heating and consequently is not subject to the same contraction

Moninger Boilers.



Base and Grates Entirely Separate and Made Up in Sections.

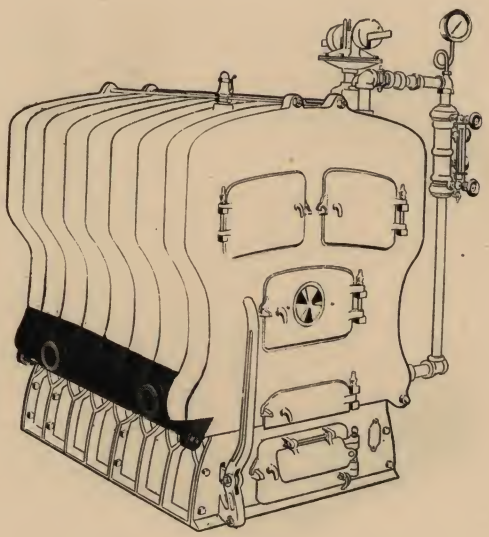
and expansion as are the parts filled with water. This base is made in sections and can be shortened or lengthened according to necessity.

When you add sections to the boiler you can add sections to the base and grates. The grates are set in slotted lugs on the inside on each side of the base and you are not obliged to cover yourself with soot and ashes every time one of them are replaced. Grates can be put in and taken out very easily. There isn't a more simple arrangement for base and grates on the market.

The shaker handle or lever handle, is connected "fast" with a long bar with projecting prongs which engage the arms on the grate bars. The shaking of the grates is thus made easy and simple. In small boilers having but few grate bars a handle is used only on one side of the base, but in larger sizes and in the long boilers, two handles are furnished and the grates divided so that each handle operates one half.

You have often heard it said that cast iron boilers were good only for Hot Water heating. Cast iron boilers, though have made such a wonderful success since they were put on the market a few years ago that the steel boiler people have said a great many things about them without effect and you probably don't remember all the talk that was put out about the Cast Iron Steam Boiler.

Moninger Boilers.



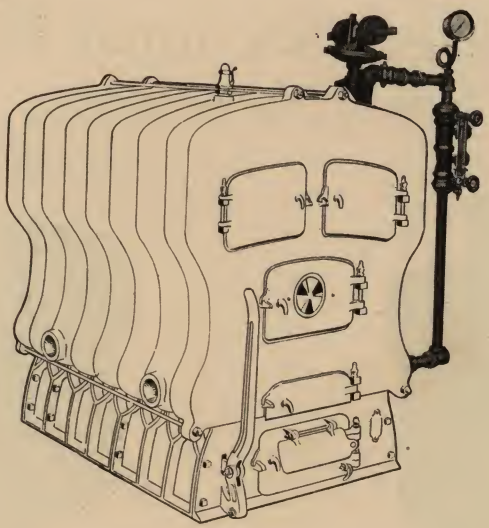
Tappings for Returns as Many as Needed and on Either Side.

Now take our word for it "it's all bosh," for a cast iron boiler if it is made right, is just as good for steam for low pressure heating as any boiler ever made, and a whole lot better than most of the so-called Tubular Steam Boilers. You can't get away from the fact that cast iron outlasts any other metal used in boiler making and if the boiler is a good boiler for heating water, why itsn't it a good boiler for making steam? You have to heat water to make steam so it is prcatically the same thing whether you heat the water for hot water or heat it for steam, the only difference being you have to make it more hot for steam heating than you would for hot water heating. Practically speaking you don't get any steam until the water is over 212 degrees and what's the difference whether you heat the water in a tea kettle or a coffee pot? When it begins to boil the steam comes out just the same. If a Cast Iron Boiler made any different steam from a Tubular Boiler, it would be so wonderful that your Local Newspaper would have a full page about it.

The boilers are tested at the factory to four atmospheres which is equivalent and the same thing as sixty pounds of steam pressure.

How in the name of common sense can anybody say that a cast iron boiler isn't a safe proposition for steam heating. It isn't worth arguing about and going into details. Take our word for it a cast iron boiler is just the thing for steam.

Moninger Boilers.



It's Made for Steam as Well as Water—A Wonder Boiler.

Here's one of many letters from customers using steam boilers.

White Marsh, Pa., April 24, 1913.

John C. Moninger Co.,
Chicago, Ill.

Dear Sirs:

The boiler I got of you done fine. I had no trouble to keep steam from 10 P. M. to 5 A. M. We had the thermometer 10 below zero here and I run the boiler with the fire door open. Thanks to you for advising the size of boiler. I put the boiler up myself and there wasn't a leak when completed. The easiest steaming boiler I ever run.

I think it is hard to beat the Moninger.

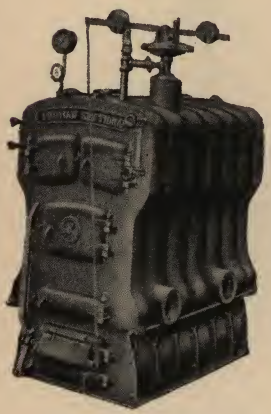
Yours truly,
Lewis A. Smith.

E. P. Weinschenk and Weinschenk & George, of New Castle, Pa., are using five of our large steam boilers to heat about 100,000 feet of glass.

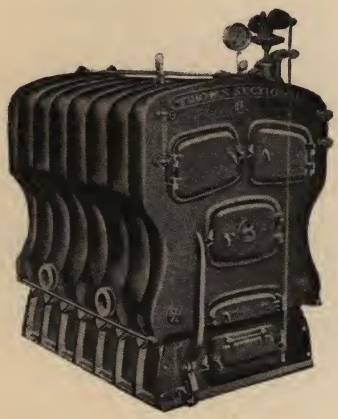
Moninger Boilers.

Moninger Sectional Boilers

FOR STEAM OR WATER



18 and 22 Series.



27 Series.

Boilers Set in a Battery.

TABLE OF SIZES, MEASUREMENTS, CAPACITIES, LIST PRICES, ETC.

Boiler Number	Total Length, Inches	Total Width, Inches	Height Return Inlet, Inches	Height Water Line, Inches	Height Flow Outlet	Width of Grate	Width of Fire Pot	Length of Fire Pot	Base, Inches	Sizes and No. Returns, Inches	Sizes and No. Flows, Inches	Diam. Smoke Pipe, Inches	Deduct from Length for Smoke Pipe	Glass Surface Boiler will Heat 45	50	55	60	65	Sq. Ft. Radiation, Steam	Sq. Ft. Radiation, Water	Amount Asbestos Cement to Cover Boiler	Shipping Weight	List Prices Steam	Water
18 Series																								
418	38	28½	14¾	40½	48	18	20	17½	30x25	2-3	2-3	10	12	1900	1725	1575	1425	1275	400	650	200	1085	$210.00	$200.00
518	45	28½	14¾	40½	48	18	20	24	30x31	2-3	2-3	10	12	2625	2400	2200	1975	1775	550	910	225	1305	245.00	235.00
618	51	28½	14¾	40½	48	18	20	30	30x37	2-3	2-3	10	12	3350	3075	2800	2525	2250	700	1170	225	1643	310.00	300.00
718	57	28½	14¾	40½	48	18	20	36	30x43	2-3	2-3	10	12	4075	3750	3400	3075	2725	850	1430	275	1781	355.00	345.00
22 Series																								
522	47	38	14¾	43½	53	22	27	23	34x31	2-3	2-3	12	14	3825	3525	3200	2875	2550	800	1320	275	1750	340.00	330.00
622	53	38	14¾	43½	53	22	27	29	34x37	2-3	2-3	12	14	4800	4400	4000	3600	3200	1000	1650	300	2089	400.00	390.00
722	59	38	14¾	43½	53	22	27	35	34x43	2-3	2-3	12	14	5750	5275	4800	4325	3850	1200	1980	325	2385	460.00	450.00
822	66	38	14¾	43½	53	22	27	42	34x50	3-3	3-3	12	14	6700	6150	5600	5050	4500	1400	2310	350	2701	520.00	510.00
27 Series																								
627	55	43	16	45½	56	27	32	31	41x40	2-4	2-4	14	16	6500	5950	5375	4825	4275	1350	2230	350	2792	510.00	500.00
727	62	43	16	45½	56	27	32	38	41x47	2-4	2-4	14	16	7925	7250	6600	5925	5275	1650	2720	400	3234	600.00	590.00
827	68	43	16	45½	56	27	32	45	41x54	3-4	3-4	14	16	9350	8575	7800	7025	6250	1950	3210	450	3556	690.00	680.00
927	75	43	16	45½	56	27	32	51	41x60	3-4	3-4	14	16	10775	9900	9000	8125	7250	2250	3700	500	3958	780.00	770.00

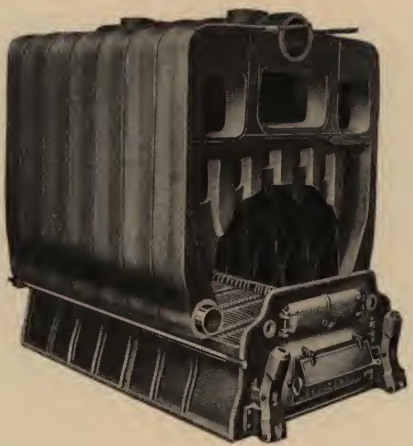
Moninger Boilers.

Our New 230 Series Boiler

"An improvement on the 33 Series"

230 Series Steam

This is our new series replacing the 33-inch Boilers. The capacities are about the same. We have a larger fire pot in this series and more indirect flue service. This makes for greater economy in fuel. Our 33-inch Boilers were coal savers but this 230 Series is a great improvement. All the other valuable features in our 33-inch Boilers have been retained, and we are confident that we have in this improved series the best and most efficient boiler of the size on the market.



230 Series Water

This series has a longer fire travel than our smaller sizes. Large boilers require the indirect surface. In this series we think we have the ideal combination of fire pot and flue surface. It works like a charm.

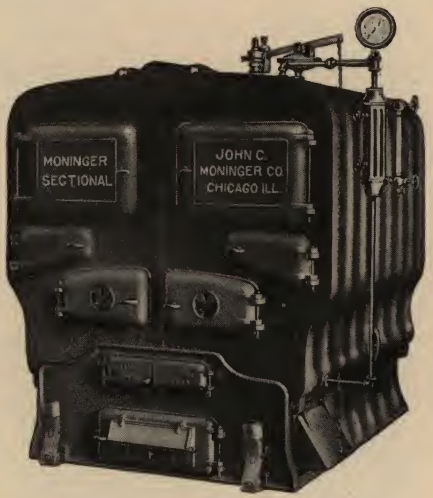
Table of Sizes, Measurements, Capacities, List Prices, etc.

230 Series

Boiler Number	Total Length, Inches	Total Width, Inches	Height Return Inlet	Height Water Line	Height Flow Outlet	Fire Pot Area, Inches	Base Dimensions, Inches	Outlets and Inlets, Inches	Diameter Smoke Collar, Inches	Deduct from Length for Smoke Pipe	Glass Surface Boiler Will Heat					Shipping Weight, Pounds	Rating Square Feet, Steam	Rating Square Feet, Water	Asbestos Cement to Cover Boiler, Lbs.	Price List, Steam	Price List, Water
											45	50	55	60	65						
235....	55	48½	17	52	65	37x32	41¼x36½	2—4	14	14	9175	8400	7625	6850	6075	3800	1900	3150	550	$ 670.00	$ 655.00
236....	63	48½	17	52	65	37x40	41¼x44¾	2—4	14	14	11225	10300	9375	8450	7525	4450	2350	3900	610	797.00	782.00
237....	71	48½	17	52	65	37x48	41¼x53	2—4	14	14	13450	12325	11200	10075	8950	5050	2800	4650	670	905.00	890.00
238....	79	48½	17	52	65	37x56	41¼x61¼	3—4	14	14	15600	14300	13000	11700	10400	5650	3250	5450	730	995.00	980.00
239....	87	48½	17	52	65	37x64	41¼x69½	3—4	14	14	17750	16275	14800	13325	11850	6250	3700	6150	790	1085.00	1070.00
240....	95	48½	17	52	65	77x72	41⅛x77¾	3—4	14	14	19975	18300	16625	14950	13275	6900	4150	6900	850	1175.00	1160.00

Moninger Boilers.

Our New Heavy Duty Boiler



New Boiler
W. N. 270 Series
Steam

This is our new series for large plants. You will notice these boilers are made in double sections. These double sections take care of expansion and contraction and avoid cracked section troubles which are so often prevalent where extra large castings are used. Another very important feature is the ease with which these sections can be handled when the boiler is installed. This is our late type of boiler and decidedly the best greenhouse boiler on the market, where large capacity is required.

Notice the fire travel in the cut below. Three times through the boiler and twice across, giving you all the heating power that coal contains.

New Boiler
W. N. 270 Series
Water

Built for the hard, heavy greenhouse work. Thicker metal and smaller castings. An extra strong boiler that will stand the strain of constant hard firing.

Table of Sizes, Measurements, Capacities, List Prices, etc.

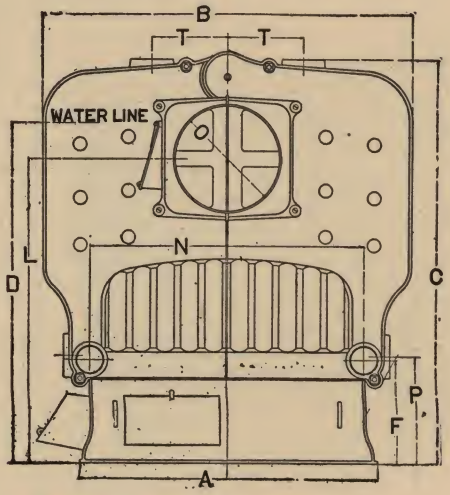
WN 270 Series

Boiler Number	Total Length, Inches	Total Width, Inches	Height Return Inlet	Height Water Line	Height Flow Outlet	Fire Pot Area, Inches	Base Dimensions, Inches	Outlets and Inlets, Inches	Diameter Smoke Collar, Inches	Deduct from Length for Smoke Pipe	Glass Surface Boiler Will Heat					Shipping Weight, Pounds	Rating Square Feet, Steam	Rating Square Feet, Water	Asbestos Cement to Cover Boiler, Lbs.	Price List, Steam	Price List, Water
											45	50	55	60	65						
WN276.,	69	71¾	20⅞	66	77¾	50x45	57¾ x 49⅝	3—5	21	15	19625	18000	16375	14750	13125	8475	4100	6775	750	1164.00	1144,00
WN277..	78	71¾	20⅞	66	77¾	50x54	57¾ x 58¾	3—5	21	15	23750	21775	19800	17825	15850	9650	4950	8175	850	1334.00	1314.00
WN278..	87	71¾	20⅞	66	77¾	50x63	57¾ x 67⅞	4—5	21	15	27850	25525	23200	20875	18550	10300	5800	9575	950	1504.00	1484.00
WN279..	96	71¾	20⅞	66	77¾	50x72	57¾ x 77	4—5	21	15	31975	29300	26625	23950	21275	12000	6650	10975	1050	1674.00	1654.00
WN280,.	105	71¾	20⅞	66	77¾	50x81	57¾ x 86⅛	4—5	21	15	36000	33000	30000	27000	24000	13200	7500	12375	1150	1844.00	1824.00
WN281..	114	71¾	20⅞	66	77¾	50x90	57¾ x 85¼	4—5	21	15	40025	36700	33375	30050	26725	14400	8350	13775	1250	2014.00	1994.00
WN282,.	123	71¾	20⅞	66	77¾	50x99	57¾ x104⅜	4—5	21	15	44150	40475	36800	33125	29450	15600	9200	15175	1350	2184.00	2164,00

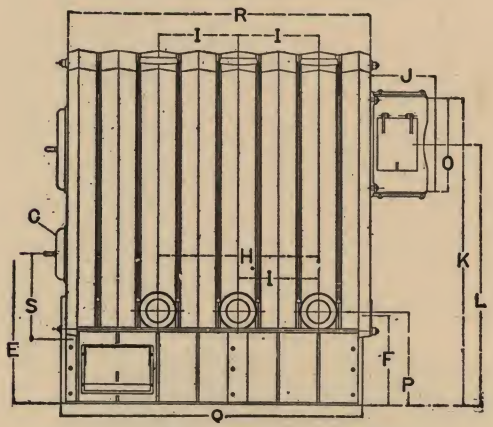
Moninger Boilers.

MONINGER SECTIONAL BOILERS MEASUREMENTS

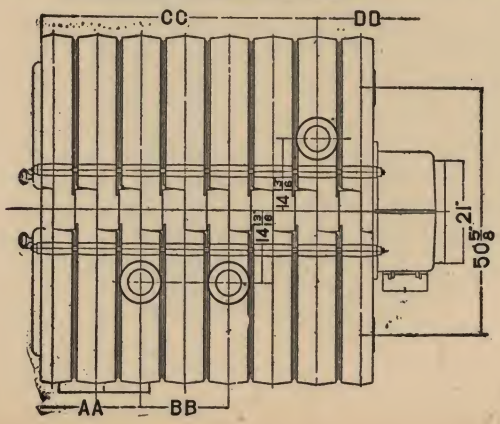
230-270 Series



Rear View of Boiler



Side View of Boiler



Cut Showing Top of Boiler

Moninger Boilers

Table of Measurements of 230, W.N. 270 Boilers

	230	WN270			
A	41¼″	57¾″	L	50″	58¾″
B	48½″	71¾″	N	...	53¼″
C	65″	77¾″	O	14″	21″
D	52″	66″	P	17″	20⅞″
E	29″	33¾″			
F	....	20⅛″	Q	235—36½ in.: add 8¼ in. for each additional section.	276—49⅝ in.: add 9⅛ in. for each additional section.
G	9¾″x15¼″	10″x17″			
H	33″	36⅜″	R	235—37½ in.: add 8¼ in. for each additional section.	276—50 7/16 in.: add 9⅛ in. for each additional section.
I	16½″	18 3/16″			
J	14″	15″	*S	18″	19¼″
K	57″	69¼″	T	...	14 13/16″

* Center of fire door above grate level.

270 Series of Boilers

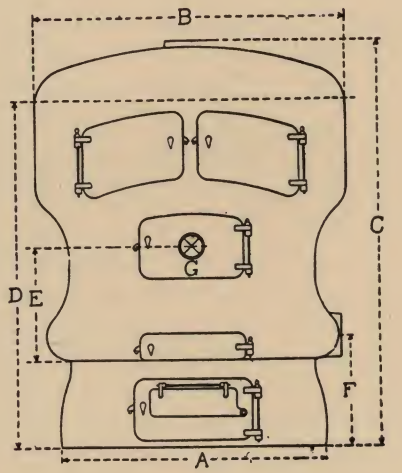
TAPPING MEASUREMENTS IN INCHES

Secs.	Right Side		Left Side	
	AA	BB	CC	DD
6	20 11/16″	.....	11⅝″	27¼″
7	20 11/16″	18 3/16″	48″	.....
8	20 11/16″	18 3/16″	57 1/16″	.....
9	20 11/16″	27 5/16″	38⅞″	27 5/16″
10	20 11/16″	36⅜″	38⅞″	36⅜″
11	20 11/16″	45½″	48″	36⅜″
12	.....	.....	.....	.....

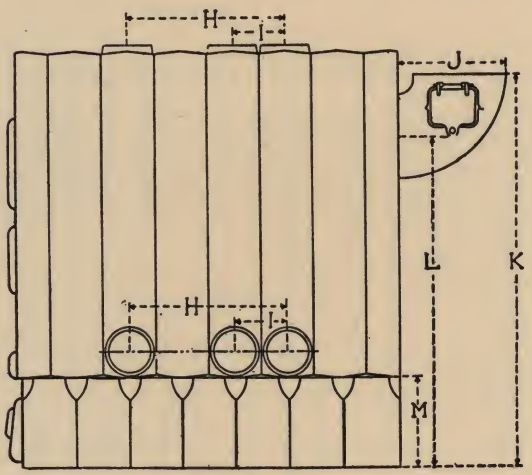
Moninger Boilers.

MONINGER SECTIONAL BOILERS MEASUREMENTS

18-22-27 Series



FRONT VIEW



SECTIONAL VIEW

For detailed measurements, see opposite page.

Moninger Boilers.

MONINGER SECTIONAL BOILERS MEASUREMENTS

	180 Series Inches	220 Series Inches	270 Series Inches
A	25½	30	36
B	28½	38	42½
C	48	53	56
D	40½	43½	45½
E	14½	14¾	16
F	14¾	14¾	16
G	7½x11½	8x13	9x14
H	18¾	18¾	20¼
I	6¼	6¼	6¾
J	12	14	16
K	44½	48	50
L	37	39	41½
M	11½	11½	12
X	26	34	41

For detailed drawings, see opposite page.

Extra tappings can be supplied at an additional charge.

Baffle Plates

In Moninger Sectional Boilers, 18, 22 and 27 Series, the spaces where fire passes into upper side flue-ways have strips along the sides of openings. Under ordinary conditions these spaces are of proper size, but special Baffle Plates are furnished which, when dropped in these openings, baffle the burning gases to rear of boiler, making a longer five travel and keeping the fire under better control. In case of a poor draft or a poor grade of coal, the plates may be removed and the thin strips clipped from openings.

Moninger Boilers.

Capitol-Winchester Boiler

Nothing but tests will actually determine the important features in construction that make for efficiency in heating. For nearly two years our Experimental Department has been at work upon the Capitol-Winchester Boiler built on new lines and embodying the fundamental features that insure efficiency.

Rotary Duplex Grate

The Capitol-Winchester Boiler is probably the first steam or hot water boiler to contain a Rotary-Duplex grate. This grate is made in two sections. The outer ring rotates on ball bearings thus doing away entirely with the removal of clinkers through a clinker door. The central section is composed of two-hand-like bars. A quarter turn of the shaker operates these bars, cutting out ashes and allowing the live coals to settle down. All mechanism in this new grate is encased and may be taken out as a unit by removing front base plate. The simple shaking operation is accomplished with the doors shut. This eliminates any possibility of dust, dirt or gas escaping into the upper rooms of the house.

Deep Fire Pot

Experience has proven that a deep fire-pot is necessary to carry sufficient fire over night for quick rekindling in the morning, and to allow the boiler to develop full efficiency with an eight-hour firing period.

Large Water Ways

The water ways in the Capitol-Winchester Boiler are large and unobstructed, thereby insuring a rapid circulation and a steady even water line.

Smoke Flues

The smoke flues are large, and staggered in such a manner that the heated gases of combustion come in contact with all heating surfaces while passing from the fire-pot to the chimney.

Trimmings

The Capitol-Winchester Steam Boiler is equipped with an automatic damper regulator, steam gauge, safety valve and try cocks. No trimmings are furnished with Water Boilers.

Moninger Boilers.

CAPITOL-WINCHESTER STEAM BOILER DETAIL

No.	R't'g. Sq. Feet	Price	Actual Grate Diam. Inches	Grate Area Sq. Feet	Height Water Line Inches	Height Outlets Inches	Outlets and Inlets Inches	Smoke Pipe Inches
3130	200	$114.00	15	1.23	42	48½	2-2½	6
3140	225	123.00	15	1.23	45	52½	2-2½	6
3230	250	132.00	17	1.58	42	49¾	2-2½	6
3240	300	149.50	17	1.58	47	54¼	2-2½	6
3330	325	158.00	20	2.18	43¾	50½	2-2½	7
3340	375	180.00	20	2.18	47¾	55½	2-2½	7
3350	425	199.50	20	2.18	52¾	60½	2-2½	7
3440	500	219.50	24½	3.27	49½	57½	2-3	8
3450	575	240.00	24½	3.27	54½	62½	2-3	8
3460	650	287.50	24½	3.27	59½	67½	2-3	8
3540	750	317.00	29	4.59	50¼	58¼	2-4	9
3550	850	346.00	29	4.59	55¼	63¼	2-4	9
3560	950	375.00	29	4.59	60¼	68¼	2-4	9
3640	1100	420.00	33	5.94	51¾	59¾	2-4	10
3650	1225	455.00	33	5.94	56¾	64¾	2-4	10
*3660	1350	492.00	33	5.94	61¾	69¾	2-4	10

Moninger Boilers.

CAPITOL-WINCHESTER WATER BOILER DETAIL

No.	R't'g. Sq. Feet	Price List	Actual Grate Diam. Inches	Grate Area Sq. Feet	Height Outlets Inches	Outlets and Inlets Inches	Smoke Pipe Inches
4130	325	$ 96.50	15	1.23	43½	2–2½	6
4140	375	105.50	15	1.23	47½	2–2½	6
4230	425	123.00	17	1.58	44¾	2–2½	6
4240	500	140.50	17	1.58	49¼	2–2½	6
4330	550	153.50	20	2.18	45½	2–2½	7
4340	625	171.00	20	2.18	50½	2–2½	7
4350	700	191.00	20	2.18	55½	2–2½	7
4440	825	210.50	24½	3.27	52½	2–3	8
4450	950	230.00	24½	3.27	57½	2–3	8
*4460	1075	277.50	24½	3.27	62½	2–3	8
4540	1225	303.00	29	4.59	53¼	2–4	9
4550	1400	336.00	29	4.59	58¼	2–4	9
*4560	1575	365.00	29	4.59	63¼	2–4	9
4640	1825	410.00	33	5.94	54¾	2–4	10
4650	2025	442.00	33	5.94	59¾	2–4	10
*4660	2225	482.00	33	5.94	64¾	2–4	10

*These boiler sizes are not recommended for soft coal. Use a boiler having one size larger fire-pot for soft coal.

Radiators.

Triton One-Column Radiators

ORNAMENTAL

For Steam and Water

Each section is 4½ inches wide. Width of legs, 5¼ inches.

For list of sizes, heights, tappings, etc., see page 216.

On special order, above radiators can be furnished with screw nipple connections.

Radiators.

TRITON ONE-COLUMN RADIATORS

LIST OF SIZES

Number of Sections	*Length Inches	Heating Surface				
		38 Inches Height 3 Square Feet per Section	32 Inches Height 2½ Square Feet per Section	26 Inches Height 2 Square Feet per Section	23 Inches Height 1⅔ Square Feet per Section	20 Inches Height 1½ Square Feet per Section
2	5	6	5	4	3⅓	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅔	6
5	12½	15	12½	10	8⅓	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅔	10½
8	20	24	20	16	13⅓	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅔	15
11	27½	33	27½	22	18⅓	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅔	19½
14	35	42	35	28	23⅓	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅔	24
17	42½	51	42½	34	28⅓	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅔	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅔	33
23	57½	69	57½	46	38⅓	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅔	37½
26	65	78	65	52	43⅓	39
27	67½	81	67½	54	45	40½
28	70	84	70	56	46⅔	42
29	72½	87	72½	58	48⅓	43½
30	75	90	75	60	50	45

Above radiators tapped 2 inches and bushed as per list on page 217.

Distance from floor to center of tapping, page 216.

On special order, above radiators can be furnished with screw connections.

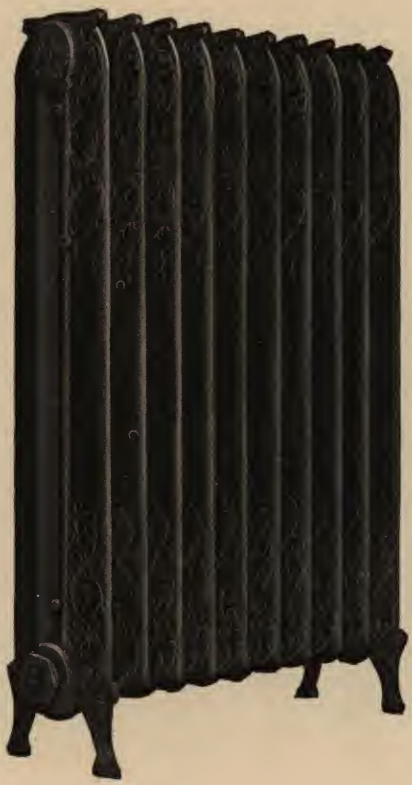
*Allow ½ inch for each bushing in estimating length of radiator.

Radiators.

Triton Two-Column Radiators

ORNAMENTAL

For Steam and Water



Each section is 7¼ inches wide. Width of legs, 8¼ inches.

For list of sizes, heights, tappings, etc., see page 216.

On special order, above radiators can be furnished with screw nipple connections.

Radiators.

TRITON TWO-COLUMN RADIATORS

LIST OF SIZES

Number of Sections	*Length Inches	Heating Surface					
		44 Inches Height 5 Square Feet per Section	38 Inches Height 4 Square Feet per Section	32 Inches Height 3⅓ Square Feet per Section	26 Inches Height 2⅔ Square Feet per Section	23 Inches Height 2⅓ Square Feet per Section	20 Inches Height 2 Square Feet per Section
2	5	10	8	6⅔	5⅓	4⅔	4
3	7½	15	12	10	8	7	6
4	10	20	16	13⅓	10⅔	9⅓	8
5	12½	25	20	16⅔	13⅓	11⅔	10
6	15	30	24	20	16	14	12
7	17½	35	28	23⅓	18⅔	16⅓	14
8	20	40	32	26⅔	21⅓	18⅔	16
9	22½	45	36	30	24	21	18
10	25	50	40	33⅓	26⅔	23⅓	20
11	27½	55	44	36⅔	29⅓	25⅔	22
12	30	60	48	40	32	28	24
13	32½	65	52	43⅓	34⅔	30⅓	26
14	35	70	56	46⅔	37⅓	32⅔	28
15	37½	75	60	50	40	35	30
16	40	80	64	53⅓	42⅔	37⅓	32
17	42½	85	68	56⅔	45⅓	39⅔	34
18	45	90	72	60	48	42	36
19	47½	95	76	63⅓	50⅔	44⅓	38
20	50	100	80	66⅔	53⅓	46⅔	40
21	52½	105	84	70	56	49	42
22	55	110	88	73⅓	58⅔	51⅓	44
23	57½	115	92	76⅔	61⅓	53⅔	46
24	60	120	96	80	64	56	48
25	62½	125	100	83⅓	66⅔	58⅓	50
26	65	130	104	86⅔	69⅓	60⅔	52
27	67½	135	108	90	72	63	54
28	70	140	112	93⅓	74⅔	65⅓	56
29	72½	145	116	96⅔	77⅓	67⅔	58
30	75	150	120	100	80	70	60

Above radiators tapped 2 inches and bushed as per list on page 217.

Distance from floor to center of tapping, page 216.

On special order, above radiators can be furnished with screw connections.

*Allow ½ inch for each bushing in estimating length of radiator.

Radiators.

Triton Three-Column Radiators

ORNAMENTAL

For Steam and Water

Each section is 9⅛ inches wide. Width of legs, 10⅛ inches.

For list of sizes, heights, tappings, etc., see page 216.

On special order, above radiators can be furnished with screw nipple connections.

How to Erect Radiators.

TRITON THREE-COLUMN RADIATORS

LIST OF SIZES

Number of Sections	*Length Inches	Heating Surface						
		44 Inches Height 6 Sq. Feet per Section	38 Inches Height 5 Sq. Feet per Section	32 Inches Height 4½ Sq. Feet per Section	26 Inches Height 3¾ Sq. Feet per Section	23 Inches Height 3¼ Sq. Feet per Section	20 Inches Height 2¾ Sq. Feet per Section	18 Inches Height 2¼ Sq. Feet per Section
2	5	12	10	9	7½	6½	5½	4½
3	7½	18	15	13½	11¼	9¾	8¼	6¾
4	10	24	20	18	15	13	11	9
5	12½	30	25	22½	18¾	16¼	13¾	11¼
6	15	36	30	27	22½	19½	16½	13½
7	17½	42	35	31½	26¼	22¾	19¼	15¾
8	20	48	40	36	30	26	22	18
9	22½	54	45	40½	33¾	29¼	24¾	20¼
10	25	60	50	45	37½	32½	27½	22½
11	27½	66	55	49½	41¼	35¾	30¼	24¾
12	30	72	60	54	45	39	33	27
13	32½	78	65	58½	48¾	42¼	35¾	29¼
14	35	84	70	63	52½	45½	38½	31½
15	37½	90	75	67½	56¼	48¾	41¼	33¾
16	40	96	80	72	60	52	44	36
17	42½	102	85	76½	63¾	55¼	46¾	38¼
18	45	108	90	81	67½	58½	49½	40½
19	47½	114	95	85½	71¼	61¾	52¼	42¾
20	50	120	100	90	75	65	55	45
21	52½	126	105	94½	78¾	68¼	57¾	47¼
22	55	132	110	99	82½	71½	60½	49½
23	57½	138	115	103½	86¼	74¾	63¼	51¾
24	60	144	120	108	90	78	66	54
25	62½	150	125	112½	93¾	81¼	68¾	56¼
26	65	156	130	117	97½	84½	71½	58½
27	67½	162	135	121½	101¼	87¾	74¼	60¾
28	70	168	140	126	105	91	77	63
29	72½	174	145	130½	108¾	94¼	79¾	65¼
30	75	180	150	135	112½	97½	82½	67½

Above radiators tapped 2 inches and bushed as per list on page 217.

Distance from floor to center of tapping, page 216.

On special order, above radiators can be furnished with screw nipple connections.

*Allow ½ inch for each bushing in estimating length of radiator.

Radiators.

Triton Four-Column Radiators

ORNAMENTAL

For Steam and Water

Each section is 12¾ inches wide. Width of legs, 13¾ inches.

For list of sizes, heights, tappings, etc., see page 216.

On special order, above radiators can be furnished with screw nipple connections.

Radiators.

TRITON FOUR-COLUMN RADIATORS

LIST OF SIZES

Number of Sections	*Length Inches	Heating Surface						
		44 Inches Height 10 Sq. Feet per Section	38 Inches Height 8½ Sq. Feet per Section	32 Inches Height 7 Sq. Feet per Section	26 Inches Height 5½ Sq. Feet per Section	23 Inches Height 4½ Sq. Feet per Section	20 Inches Height 4 Sq. Feet per Section	18 Inches Height 3½ Sq. Feet per Section
2	6	20	17	14	11	9	8	7
3	9	30	25½	21	16½	13½	12	10½
4	12	40	34	28	22	18	16	14
5	15	50	42½	35	27½	22½	20	17½
6	18	60	51	42	33	27	24	21
7	21	70	59½	49	38½	31½	28	24½
8	24	80	68	56	44	36	32	28
9	27	90	76½	63	49½	40½	36	31½
10	30	100	85	70	55	45	40	35
11	33	110	93½	77	60½	49½	44	38½
12	36	120	102	84	66	54	48	42
13	39	130	110½	91	71½	58½	52	45½
14	42	140	119	98	77	63	56	49
15	45	150	127½	105	82½	67½	60	52½
16	48	160	136	112	88	72	64	56
17	51	170	144½	119	93½	76½	68	59½
18	54	180	153	126	99	81	72	63
19	57	190	161½	133	104½	85½	76	66½
20	60	200	170	140	110	90	80	70
21	63	210	178½	147	115½	94½	84	73½
22	66	220	187	154	121	99	88	77
23	69	230	195½	161	126½	103½	92	80½
24	72	240	204	168	132	108	96	84
25	75	250	212½	175	137½	112½	100	87½
26	78	260	221	182	143	117	104	91
27	81	270	229½	189	148½	121½	108	94½
28	84	280	238	196	154	126	112	98
29	87	290	246½	203	159½	130½	116	101½
30	90	300	255	210	165	135	120	105

Above radiators tapped 2 inches and bushed as per list on page 217.

Distance from floor to center of tapping, page 216.

On special order, above radiators can be furnished with screw nipple connections.

*Allow ½ inch for each bushing in estimating length of radiator.

Radiators.

Triton Five-Column Radiators

ORNAMENTAL

For Window

For Steam and Water

Each section is 12¾ inches wide. Width of legs, 12¾ inches.

For list of sizes, heights, tappings, etc., see page 216.

On special order, above radiators can be furnished with screw nipple connections.

Radiators.

TRITON FIVE-COLUMN RADIATORS

WINDOW

LIST OF SIZES

Number of Sections	*Length Inches	Heating Surface			
		20½ Inches Height 5½ Square Feet per Section	16½ Inches Height 4⅔ Square Feet per Section	14½ Inches Height 4 Square Feet per Section	12½ Inches Height 3⅓ Square Feet per Section
2	6	11	9⅓	8	6⅔
3	9	16½	14	12	10
4	12	22	18⅔	16	13⅓
5	15	27½	23⅓	20	16⅔
6	18	33	28	24	20
7	21	38½	32⅔	28	23⅓
8	24	44	37⅓	32	26⅔
9	27	49½	42	36	30
10	30	55	46⅔	40	33⅓
11	33	60½	51⅓	44	36⅔
12	36	66	56	48	40
13	39	71½	60⅔	52	43⅓
14	42	77	65⅓	56	46⅔
15	45	82½	70	60	50
16	48	88	74⅔	64	53⅓
17	51	93½	79⅓	68	56⅔
18	54	99	84	72	60
19	57	104½	88⅔	76	63⅓
20	60	110	93⅓	80	66⅔
21	63	115½	98	84	70
22	66	121	102⅔	88	73⅓
23	69	126½	107⅓	92	76⅔
24	72	132	112	96	80
25	75	137½	116⅔	100	83⅓
26	78	143	121⅓	104	86⅔
27	81	148½	126	108	90
28	84	154	130⅔	112	93⅓
29	87	159½	135⅓	116	96⅔
30	90	165	140	120	100

Above radiators tapped 2 inches and bushed as per list on page 217.

Distance from floor to center of tapping page 216.

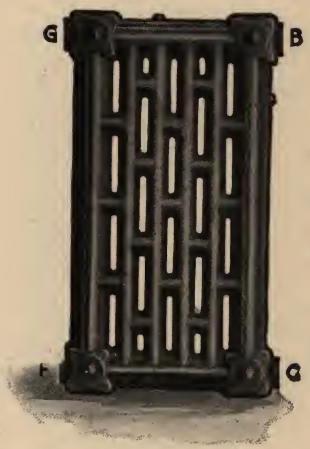
On special order, above radiators can be furnished with screw nipple connections.

*Allow ½ inch for each bushing in estimating length of radiator.

Radiators.

Athenian Wall Radiators

For Steam and Water



This style of radiator is well adapted to heat small rooms, narrow halls, bath rooms, churches, gymnasiums, car barns, factories, steamships, etc. where floor space is limited. They are built up in various ways so that they may be used horizontally, vertically or in flat form for hanging on ceilings, etc.

SIZES AND MEASUREMENTS

Made in Three Sizes

Sizes	No. of Square Feet in Each Section	Width of Each Section	Length of Each Section	Thickness of Each Section	Extends from Wall with Bracket
Extra large....	9	13¼	29¼	3	3¾
Standard	7	13¼	24¼	3	3¾
Small	5	13¼	19¼	3	3¾

RADIATOR PRICE LIST

PER SQUARE FOOT OF HEATING SURFACE

Height, inches	45	44	38	32	26	23	22	20½	20	18	17	16½	14½	14	12½
Price per square foot, cents	42	42	42	46	50	53	53	57	57	58	59	60	64	64	68
One-column															
Puritan One-column, Steam and Water	..	..	3	2½	2	..	1⅔	..	..	1⅓					
Florentine One-column, Steam and Water	..	..	3	2½	2	..	1⅔	..	..	1⅓					
Triton One-column, Plain or Ornamental, Steam and Water	..	..	3	2½	2	1⅔	..	..	1½						
Grecian One-column, Steam and Water	..	..	3	2½	2	1⅔	..	..	1½						
Two-column															
Puritan Two-column, Steam and Water	5	..	4	3⅓	2⅔	..	2¼	..	..	1¾					
Florentine Two-column, Steam and Water	5	..	4	3⅓	2⅔	..	2¼	..	..	1¾					
Triton Two-column, Plain or Ornamental, Steam and Water	..	5	4	3⅓	2⅔	2⅓	..	..	2						
Grecian Two-column, Steam and Water	5	..	4	3⅓	2⅔	2⅓	..	..	2						
Sun Two-column, Steam and Water	5	..	4	3⅓	2⅔	2⅓	..	..	2						
Three-column															
Puritan Three-column, Steam and Water	..	6	5	4½	3¾	..	3	..	..	2¼					
Florentine Three-column, Steam and Water	..	6	5	4½	3¾	..	3	..	..	2¼					
Triton Three-column, Plain or Ornamental, Steam and Water	..	6	5	4½	3¾	3¼	..	..	2¾	2¼					
Grecian Three-column, Steam and Water	6	..	5	4½	3¾	3¼	..	..	2¾						
Sun Three-column, Steam and Water	6	..	5	4½	3¾	3¼	..	..	2¾						
Four-column															
Puritan Four-column, Steam and Water	..	10	8½	7	5½	..	4½	..	..	3½					
Florentine Four-column, Steam and Water	..	10	8½	7	5½	..	4½	..	..	3½					
Triton Four-column, Plain or Ornamental, Steam and Water	..	10	8½	7	5½	4½	..	..	4	3½					
Grecian Four-column, Steam and Water	10	..	8	6½	5	4¼	..	..	3½						

Window															
Puritan Five-column, Steam and Water . .	..	..	..	..	..	..	..	..	5½	..	4¾	..	..	4	
Triton Five-column, Plain or Ornamental, Steam and Water	..	..	..	..	..	..	..	5½	..	..	..	4⅔	4	..	3⅓
Utility Six-column, Steam and Water . . .	..	..	..	..	7	..	6	..	..	5	..	..	..	4	
Triton Flue, Steam and Water	..	..	7	5¾	4½	.	..	..	3¼						

The number of square feet contained per section is shown opposite each pattern under the different heights in which it is made.

ATHENIAN WALL RADIATORS

FOR STEAM AND WATER

Large section, 9 square feet; Standard section, 7 square feet, per square foot	$0.42
Small section, 5 square feet, per square foot	.46

INDIRECT RADIATORS

FOR STEAM AND WATER

Pin, 10 square feet per section, with slip nipple joints, per section	$2.70
Pin, 15 square feet per section, with slip nipple joints, per section	4.05
Pin, 20 square feet per section, with slip nipple joints, per section	5.40
Champion, prime surface 10 square feet per section	2.70

NOTE—When so ordered, Pin Indirect Radiators can be furnished with hexagonal center screw nipple connections or inside R. and L. screw nipples for either of which 10 per cent will be added to net price. Extra for assembling Indirect Radiators one cent per square foot, net.

Above prices subject to change without notice.

SPECIAL DATA ON UNITED STATES RADIATORS

MEASUREMENTS OF SECTIONS AND TAPPINGS

Style		Dimensions of Sections			Distance from Floor to Center of Tapping		Distance from Floor to Center of Upper Tappings													
		Width In.	Width Legs In.	Thickness In.	Water and Steam Supply and Return, In.		45 In.	44 In.	38 In.	32 In.	26 In.	23 In.	22 In.	20½ In.	20 In.	18 In.	17 In.	16½ In.	14½ In.	14 In.	12½ In.
					Slip Nipple	Screw Nipple															
Puritan and Florentine	One-column	4½	5½	2½	4				35½	29½	23½		19¾			15¾					
	Two-column	7⅛	8⅛	2½	4	4½	42¼		35½	29½	23½		19¾			15¾					
	Three-column	9⅛	9⅛	2½	4	4½		41½	35½	29½	23½		19¾			15¾					
	Four-column	12½	13½	2¾	4½			41½	35½	29½	23½		19¾			15¾					
	Five-column	13	13	3	3½										18		15			12	
Triton Plain and Ornamental	One-column	4½	5¼	2½	4¼	4⅞			35½	29⅝	23⅝	20⅝				17⅝					
	Two-column	7¼	8¼	2½	4¼	4⅞		41½	35 7/16	29⅝	23⅝	20⅝				17⅝					
	Three-column	9⅛	10⅛	2½	4¼	4⅞		40⅞	35 9/16	29 9/16	23⅞	20 11/16				17⅞	15⅞				
	Four-column	12¾	13¾	3	4⅛	4¾		40⅞	35 1/16	29 1/16	23 1/16	20¼				16 13/16	15¼				
	Five-column	12¾	12¾	3	3									18½					14 5/16	12¾		10¼
	Flue	9⅛	9⅛	3		5½			30¾	24 13/16	18⅝					12 13/16					
Grecian and Sun	One-column	4½	5	2½	4½	5			35¼	29¼	23¼	20¼				17¼					
	Two-column	7¾	8¼	2½	4½	5	42¼		35¼	29¼	23¼	20¼				17¼					
	Three-column	9	9¾	2½	4½	5	42¼		35¼	29¼	23¼	20¼				17¼					
	Four-column	11	11¾	3	4½	5	42¼		35¼	29¼	23¼	20¼				17¼					
Utility	Six-column	11¼	11¼	3	3½	3½					24		20			16				12	

Allow ½ inch for each bushing in estimating length of radiators.

Radiators.

RADIATOR TAPPING LIST

STEAM

ONE-PIPE WORK

Radiators containing 24 square feet and under	1 inch
Above 24, but not exceeding 60 square feet	1¼ inch
Above 60, but not exceeding 100 square feet	1½ inch
Above 100 square feet	2 inch

TWO-PIPE WORK

Radiators containing 48 square feet and under	1 x ¾ inch
Above 48, but not exceeding 96 square feet	1¼ x 1 inch
Above 96 square feet	1½ x 1¼ inch

WATER

TAPPED FOR SUPPLY AND RETURN

Radiators containing 40 square feet and under	1 inch
Above 40, but not exceeding 72 square feet	1¼ inch
Above 72 square feet	1½ inch

All Direct Radiators are regularly made with air valve tappings ⅛ inch. When radiators are ordered for vapor or vacuum heating, specific instructions should be given as to method of tapping.

Water radiators are regularly shipped with blank at top of leg sections, but can be tapped 1½ inches or smaller on special order.

Unless otherwise ordered, all openings of Direct Radiators will have right-hand threads (except that of Wall Radiators where tapped 1½ inches, in which case tapping at one end is right-hand and left-hand on opposite end).

All Radiators listed herein (except Triton Flue and Athenian Wall Radiators) are constructed with heavy non-corrosive push nipples.

Setting Boilers in Batteries

The economy of the battery of boilers is readily apparent and this style of installation is being rapidly adopted not only by florists but in other lines of heating and power work. The advantages are many but the principal ones are these.

ECONOMY—In moderate weather one boiler with a small grate surface and fire-pot can be relied on to do all the work. This makes for economy as it costs less money to run a small boiler than it does to run a large one. Practically the entire winter one boiler will do all the work and only in extreme weather will it be necessary to bring both of them into action.

ABSOLUTE SAFETY—In a greenhouse when the boiler gives out during the winter it practically means the loss of the entire stock of plants and flowers. With two boilers connected in a battery and properly valved, should anything happen to one it can be shut off and temperature kept high enough to prevent freezing until repairs are made. This gives you first-class insurance at a very low rate.

DURABILITY—Boilers being constantly operated under a light load are not subject to undue strain and will therefore last longer than where a single boiler is used and constantly operated. With two boilers a change can be made from one to the other operating in moderate weather. This divides the work and gives one boiler a chance to rest.

PERFECT CONTROL—There being two valves on the flow and two on the return main, system is always under control. Connections to the header can be made at any time by removing flanges. Extra fittings for future connections can be put in at time header is made. No need to change your boiler tappings up to the capacity of the header. Sections can be added to boilers in a battery the same as to a single boiler and header extended to connect several boilers in one battery. As many as 12 boilers can be twinned together and operated singly or as a unit.

How to Erect Sectional Boilers.

How To Erect Sectional Boilers

It is not only necessary that a boiler be carefully manufactured, but it is just as necessary that it be put together properly. A large number of faults found with cast iron boilers are due to the fact the people putting up the boiler did a poor job. All of the parts are made with the greatest accuracy so they will fit together absolutely perfect and, unless care is taken in erecting, you are sure to have trouble before long.

It has been customary to furnish printed instructions for setting up the boiler but it was necessary to use technical terms and phrases which were not readily understood by florists and, in fact, experienced steam-fitters many times had trouble following the printed instructions. For this reason we have had a photographer take several views of a boiler being set up, and we are reproducing these on the following pages together with description and details so when you get your boiler it will be an easy matter to set it up complete and do the job right.

The first thing to be done is to make a good foundation on which to set the boiler. This foundation can be made in two ways.

The easiest and most simple method is to make a level cement floor somewhat larger than the base. This cement floor will form the bottom of the ash pit and base of boiler can set diretcly on it. Be sure this foundation is perfectly level and that base when set is also perfectly level.

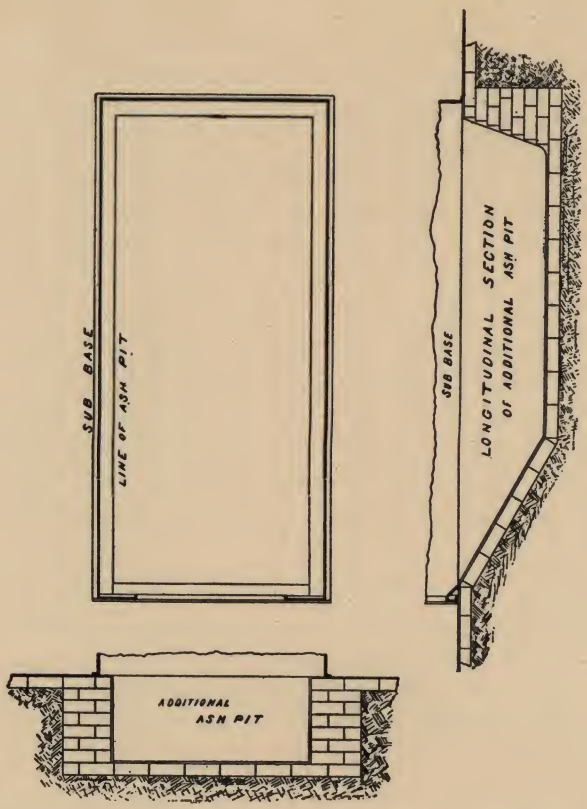
Another and better method is to make a foundation as shown in the drawing on next page. This will give you extra room for ashes, and will probably save you several dollars on grate bars. We strongly recommend a foundation of this kind.

Before you attempt to put the boiler together, make yourself well acquainted with all of the different parts and be sure you are right before you go ahead.

It sometimes happens that parts will fit into places where they do not belong and nothing should be taken for granted just because it happens to fit. Each part must be put in its place and work must be done absolutely right. Take all of the parts of the boiler and check them over carefully with the shipping list you will find packed in one of the boxes. See that you have everything that belongs to the boiler before you begin to set it up. Lay all of the parts out on the floor but be careful you do not get them scattered too much as the little pieces are liable to be lost. Many times pieces are lost in refuse and waste that is always around where building is going on.

How to Erect Sectional Boilers.

After everything is sorted look the pieces over closely and as near as possible re-sort them so all fittings for grates and base will be in one place and fittings for the sections will be in another place. You are now ready to begin the work.



It will be found of much value, when the conditions will permit, to deepen the ashpit by either making a raised foundation of brick under edge of boiler, or by excavating and cementing the sides and ends, as shown in the illustration above.

For many sizes of our boilers we are able to put the base together complete at the factory and ship it to you ready to set in place, but some of the large sizes cannot be handled in this manner and must be put together when the boiler is set up.

How to Erect Sectional Boilers.

Here is the Start—Assembling the Base on Which the Sections Rest.

This cut shows one of the bases being put together. You will notice the base consists of four principal pieces, the two sides, front and back. The front and back is joined to the sides by means of machine bolts and there are two of these bolts to be put in on each side. Place the head of the bolt outside and the nut inside making both tight with a small wrench. The front and rear part of the base carries a small piece of grate that comes fastened to it. This small piece of grate acts as a clinker crusher for the last grate bar in the boiler. The lugs shown on the inside of the base carry the ends of the grate bars and you will find one of these on each side for each bar. These lugs are held in place by small stove bolts and nuts in most sizes. The stove bolts pass through the base to the outside and grate lugs can be fastened in place with a screw driver after grate bars are put in. In some of the sizes lugs are made stationary and slotted so that grate bars can be lifted in and out without adjustment of the lugs. With all boilers with stationary grate lugs, leave off back of base until grates are all connected. After grates are all in place put rear part of base in place.

When you have the base joined together, the next thing to do is to put in the grate connecting levers. On the front plate of the base you will find a slotted opening on each side and similar openings in the back plate. The grate connecting arms should be set into these openings at each end so the prongs project outward toward the center of the boiler.

This grate connecting arm is joined in the center and bolts should be loosened so that each end can be pushed through the slotted opening in the base and then tightened again.

In some of the larger sizes the slotted openings are only in front of base and you will find grate bar prongs are slotted. The grate shaking arm passes through these slotted openings and notches fit over lower part.

How to Erect Sectional Boilers.

Placing Grates in Position—the Last Work on the Base.

This style of shaking arm is connected to a piece of casting extending through the slotted openings in front of base, and shaking lever is connected to this piece.

After the base is set up complete as shown, you are ready to put in the grate bars, and as explained, these bars set into the lugs shown on the sides of the base plates.

When you put in the grate bars see that arms extending down into the base are in proper position to engage the prongs on the grate connecting rods. If this is not done your grates will not shake when the lever handle is operated. As soon as the grates have all been put in it is a good plan to operate the connecting rod by hand to see that all the bars move together uniformly and that arms on the grate bars properly engage the prongs on the grate connecting rod. Be sure your grates operate perfectly before you set up the sections as it is far easier to remedy any mistake at this time than it will be later.

If you have two handles for shaking the grate or if you have two sets of grate connecting arms, one for each side, the front half of the grates should engage the prongs of the grate connecting rods on one side and the rear half of the grates should engage the rods on the opposite side. In this way you will be able to operate one half of the grate with each of the lever handles on the front of the boiler. Either half of the grates can be connected to lever arm on either side of the boiler.

In some of the small sizes of boilers all of the grates are operated by one handle. Where you have only one lever handle, be sure the arms on the grate bars are all placed on the side of the boiler where the grate connecting rod is.

The back section usually is the first section placed on the base. Get the section set in proper position on the base so that rear part of it comes

How to Erect Sectional Boilers.

And Now Comes the First Section—the Back of the Boiler.

The Iron Push Nipple.

even with the edge of the base flange and the lugs on each side through which the draw rods pass are equal distance from the side base flange.

On our 230 and 270 series the front section is the first to set up and should be bolted to front base plate.

The section will not set in place on the base wtihout being braced so before you proceed to erect boiler steady the section and brace it very carefully from the rear. A 2x6 plank with a short piece of 2x4 nailed across it to form a cross makes a good brace. This cross can be set up so the upper part projects through the flue opening from the back and the lower end rests against a stake or some other object that is sationary. Let the section lean toward the back on this cross until you have the next section in place.

Now carefully clean each of the port openings into which the push nipples are to fit. You will notice there are three of these in the section; one large one at the top and two small ones, at the bottom. These port openings are very carefully reamed and form a perfect triangle.

All three openings are made at one time by a special machine, built for this one purpose and are absolutely accurate, not only in size, but in relative location to each other. After the openings are cleaned of all grease, sand, etc., wipe off three of the push nipples, one large and two small. Insert these nipples in the openings but do not drive them in tight. Be sure the nipples are fitted in very evenly all around and firm enough so they will not easily come out.

How to Erect Sectional Boilers.

The Second Section is One of the Intermediate Units.

After this is done you are ready to put on the next section, but before doing so, be sure the section is well braced and will not topple over from the jar of handling the second section.

The second section to be placed on the base is one of the regular intermediate sections. Generally this is a tapped section for flow and return, but if boiler has eight sections or over you can put a blind section next to the back. The boiler being erected as shown in the cuts is an eight section boiler, our No. 833, so the next to the last section has no tappings. This section is one of the most important sections in the boiler and if it is not carefully set in place you will have trouble before all of the sections are erected on the base. Be sure to clean port openings carefully before you start to set it up.

When you get this section up on the base push it as close as possible to the back section and see that it sets perfectly plumb, which it will if your base has been set level. Draw the lower legs close to the push nipples that are in the port openings in the back section and then raise the back section off from the brace that you set up to hold it in place. Now force the second section against the push nipples in the second section at the same time evenly.

How to Erect Sectional Boilers.

And so is the Third One, but this Section Generally is Tapped.

Now get both sections perfectly plumb and be extremely careful to have them square with the base. If the sections are not perfectly square with the base when you add additional ones you will find the lower ends on one side extending over the grates or your push nipples will not enter squarely into the port openings, thus causing a leak.

When the sections are both set up take another look at the push nipples to see they are still evenly entered in all three places in both sections. Steady the sections and enter the draw clamps. On the second page from this you will find illustration showing how to use these draw clamps. Draw the sections as evenly as possible, first making two or three turns on one clamp and then two or three on another, using only a medium-sized monkey-wrench for this work. Do not use a heavy wrench and try to force the sections. The nipples and openings as before stated are absolutely perfect and sections should go together smooth and easy. You will gain nothing by force and you may crack either a nipple or a section. Let us say it again, be extra careful in drawing these sections together for on this hinges the success or failure of the boiler. There is nothing so disgusting as a leaking boiler or a damaged one. Even though you do spend considerable time in drawing the sections together, it is time well spent and will save you no small amount of trouble, worry and expense.

How to Erect Sectional Boilers.

As You See Two Men Can Set it up Complete.

After you have your second section in place, very carefully brace the back section again so it will not move backward.

Get the third section up on the base about as shown here. Let one fellow steady the section on the base while the other carefully removes the draw clamps from the port openings. Remove the two lower draw clamps first inserting push nipples in the port openings after both have been carefully cleaned and greased.

Now remove the upper draw clamp, holding the section as steady as possible while doing so. After upper port opening has been carefully cleaned and nipple inserted, properly greased, you are ready to move up the next section. Before you begin to enter the push nipples into this section be sure the port openings are all good and clean and greased. We are repeating some of these things several times so you will be sure to make no mistake.

Now enter the nipples into the ports in the same manner you did those between the rear section and second section, being careful, however, that you do not disturb the position of the two sections you have already set up.

The third section in a boiler of eight sections should be one with a tapping for flow and return pipe. The boiler we are illustrating is a No. 833 boiler which has eight sections and, therefore, this one is tapped. In putting on this tapped section which otherwise is one of the regular

How to Erect Sectional Boilers.

The Famous Draw Clamps in Action—no Wood Blocks.

intermediate sections, be sure to get the return opening at the bottom on the side of the boiler to which you intend to connect your return pipe. The intermediate sections are all interchangeable and return opening can be set on whichever side is convenient for you. Sometimes you want all of the return tappings on one side, and, then again, you may want one on one side and the other on the opposite side. You can suit yourself about this, but take notice of it when you set the section up and not after the boiler is erected complete.

When third section is in place they will stand alone fairly firm and steady. Insert draw clamps in this section the same as you did before and draw them together very carefully and see that nipples surely go in even all around in all of the three openings in the two sections. You can now remove the draw clamps before proceeding with the next section.

The directions given for setting in place the third section can be used for all intermediate sections except for the one placed next to the front section, which will be described later. Be very careful with each section when you set it up, for if you do not get the sections perfectly square with each other, plumb on the base and perfectly in line as regards port openings and nipples, you will have a great deal of trouble afterward to remedy the defect.

You will probably notice the sections spring apart a trifle when the draw clamps are removed. This may be due to several things. On ac-

How to Erect Sectional Boilers.

Each Section Drawn Up Perfect as You Go Along.

count of the size of the castings there is a certain per cent of shrinkage and warping in the foundry, so the outside measurements are not absolutely the same on each section. Sometimes one section will rest on the base and another, when nipples are entered in the ports, will not. It is absolutely necessary that nipples enter the port openings perfectly, so you will need to put wedges or blocks under the sections on the base to support them. Small pieces of band iron such as is used on bales of hay or around boxes for packing, etc., can be used beneath the sections to support them on the base. Be careful to do this, for unless section is resting firmly on the base it is liable to give or slip off somewhat from some of the push nipples.

Another cause may be that one side of the section has a small rough projection that just happens to strike a similar projection on the adjoining section. If this is the case, when the lower draw clamps are removed the sections will spring apart at the bottom and if they are tightened again and the upper one loosened, the sections will spring apart at the top, assuming, of course, projection is somewhere around the center flue way. If you find this to be the trouble take a chisel and cut off the projection. A small amount of give though, when draw clamps are removed, is of no consequence and will be taken up again when the long draw rods are finally put in with the last section.

Sometimes both sections have a maximum amount of warp in them and if the bowed sides are placed against each other the section will not

How to Erect Sectional Boilers.

This Special Section Next to Front has Side Water Flues Cut Away.

hold at top or bottom. The remedy for this is, take first section off and turn it around and try it. If it is a tapped section and cannot be turned take off two sections and turn the one next to the tapped section.

You will notice, too, some of the nipples seem to enter more than others and the distance between sections on one side of the boiler may be greater than those on the opposite side.

If you are sure the nipples are entered squarely pay no attention to this difference in the distance sections are apart.

To get light inside the boiler use a candle placed in the flue ways. With this candle you can generally see all sides of the push nipple and notice whether it is square or not. Be sure, too, to examine the push nipples before you enter them. Through error or mistake you may get a defective nipple and for this reason two or three extra are always sent with every boiler. Use the ones that are absolutely perfect and those that have no sand or defects on their outside surface.

All intermediate sections are the same except the one next to the front and on this section you will find a plate which reads "Next to front." You will notice the flue ways in this section are cut away and the water part is narrower than in the other intermediate sections. The reason for this is that smoke and gases coming through the side flues toward the front must have ample space in which to turn to enter the center flue in their travel toward the rear of the boiler and the chimney.

How to Erect Sectional Boilers.

The Front Section Carries all Fire and Flue Doors.

Be sure this section next to the front is properly set up, for it is one of the most important parts of the boiler and on it depends the successful operation of the fire travel. This section has an extra tapping in the upper part, as you will notice on the cut. This tapping is used only when the boiler is for steam and in a hot water boiler should be plugged. The diaphragm or draft regulator that goes with the steam boiler is attached to this opening. This section should be set in place in the same manner as preceding ones. The only difference being its relation to the front section and the position in which it is placed on the base. In an eight section boiler such as we have illustrated here this is the seventh and next to last section.

After this is in place you are ready to put on the front section, but before doing so, make sure again that grates all operate perfectly and that all push nipples are squarely and evenly entered in the port openings in the various sections.

This section after set up will come about even with the front of the base. As there are no openings extending entirely through this section it will not be possible to use the draw clamps at the ports, the same as you have done on the other sections.

How to Erect Sectional Boilers.

The Long Draw Rods Insure Even Expansion and Contraction.

Get the section on the base and enter it as evenly as possible on all of the push nipples which you have previously inserted in the port openings in the section just set up and then put on the draw rods. At the top of the sections you will find two lugs and at the bottom of each side one lug, both on the front section and the back section. Through the openings in these lugs the draw rods should be passed.

The draw rods can be put in either from the front or the back, but nuts should be placed on one end of the draw rods first and turned up enough so thread has a good hold. This should let the draw rod extend through the lugs on the section on other end about one-half inch or enough of the thread on the rod so the nut can be caught on the thread. Put on all four nuts on the rods and turn them up evenly so the section will be forced over the push nipples into the ports squarely. Use just as much care in turning up the nuts on the draw rods as you did in using the draw clamps on the previous sections.

This section must fit perfect on all three of the nipples so there will be no leak when the boiler is completed. Use a small wrench on these rods. In fact, it is not desirable to use a large wrench on any part of the boiler and we caution you against forcing any part of the boiler into place.

Everything must fit perfectly and must go into its place easily.

A twelve or fourteen inch wrench is plenty large for any work to be done in connection with drawing the sections together.

How to Erect Sectional Boilers.

Openings Between the Sections in Center Flue are all Cemented.

In the cut you will notice draw rods are being put in from the rear and also that a twelve inch wrench is being used to tighten the nuts.

After you have this section in place plug return openings and fill the boiler with water. After this is done look over all of the connections very carefully and see if you have any leaks. If you find a leak at any of the push nipples take wrench and draw up on the nuts on the draw rods. Do not use too much force but try to bring sections closer together to stop the leak. Leaks at push nipples are in nearly every case due to carelessness in drawing sections together, but sometimes sections are not drawn up tight enough and this may be your trouble. If the leak does not stop it will be necessary to take the boiler apart again and examine everything very carefully to find out what the trouble is. Before taking the boiler apart, though, look over all the joints and see if there are further leaks. Locate all of the leaks before you take the boiler down, so everything can be fixed at one time. All sections and nipples are carefully tested before being shipped and there can be no leak except it be the fault of setting up the boiler. It is only on rare occasions you will find any leaks if you are careful when you put the sections together.

If boiler is tight you are now ready to commence on the cementing.

How to Erect Sectional Boilers.

Door Hinge Pieces and Catches all Separate—Easy to Keep Doors Tight.

Place cement between the sections from front to back of boiler through the center flue. Cement is used on each side and at top and bottom of the center flue between all of the sections except the front section and the one immediately back of it. Cement is used at the bottom and top of the center flue between all of the sections from front to back. The cementing can be done from the rear as well as from the front, so you can reach all parts easily. Be careful to close these openings between the sections so that that no smoke or gas from the coal can enter the center flue way except through the special openings provided for in the section next to the front.

Cement on the outside between all of the sections. Be careful to force cement well in between the sections so it will have enough body to stay in place and also cement carefully around the lower edge of the sections and the base plate. The openings between the base and the bottom of the sections must be filled with cement so no air can come up through the grate except through the draft door provided on the front of the base. A boiler can have a draft in only one place, so be sure you close the openings all around at the bottom of the sections. Enough cement to properly do the work will be sent with the boiler and use all of

How to Erect Sectional Boilers.

All Outside Openings Cemented Tight with our Special Cement.

this so there will be plenty of body at all points and cement will not crack off or scale.

After boiler is cemented put on all of the lugs for doors. You will find a small lug for each door for the catch and a large one with two openings for the door pins or hinges. When these are in place you can put on the doors. After doors are on, close them and notice whether they fit perfectly tight against the section and fall into the catch easily. If the door does not close perfect take off the hinge lug and turn it upside down. You will now find the door will swing to, just right.

All doors are fitted to the section before shipping and trimmed on an emery wheel so they shut perfectly tight against the frame cast on the section. By turning the hinge lugs one way or the other the doors will all shut practically air tight. Take your time in fitting these doors and get them as near perfect as you can, for if any air spaces are left around the edges they will interfere with the draft.

These air spaces often cause a boiler to do poor work and in addition are a nuisance on account of the singing noise the air makes in passing through the cracks. Some of the boilers have separate frames for doors and these are fastened to openings at corners with stove bolts.

How to Erect Sectional Boilers.

Grate Shaking Handles Attached on the Balance Principle—No Locks.

You are now ready to put on the grate shaking levers.

With some of the smaller boilers only one handle will be furnished, but with the large boilers and with those having six or more grate bars two shaker handles will be supplied, one for each side. If you have only one handle it will operate the entire grate and if you have two handles connect one to the front half of the grate and the other to the rear half. The lower part of the shaking lever or handle connects to a lug on the base with a bolt and nut and just above this, connection is made to the grate connecting rod, also with a bolt. When these handles are connected try them and watch the grates to see if they work perfectly. Operate the handle several times to see if any of the parts are loose or out of place. The shaking levers after connected should operate the grates easily. The arm when at highest point should just touch the front section of the boiler and the grates inside should be in proper position ready for firing. When handle is at lowest point grates should be turned half way open. Be careful to notice just how the grates operate before you begin to fire so after you have coal in the boiler you will know how much to move the shaking lever to get the proper results.

The hot water thermometer on a hot water boiler can now be attached. This thermometer should be screwed into the one-half inch tapped opening at the top on the left hand side of the front section. If the boiler is for steam you are now ready to put on the steam trimmings.

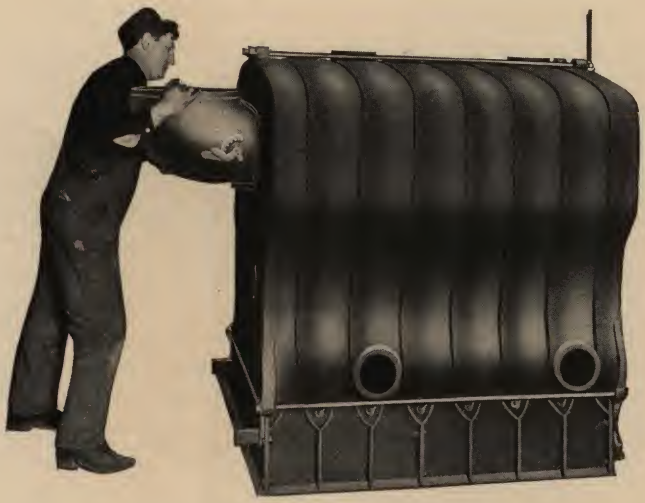
How to Erect Sectional Boilers.

The Famous "Flexible Fire Travel" is Made With These Plates.

These steam trimmings are attached to the front section and the section immediately back of it. The front section has two openings: one at the top and one on the side down near the base. Into each of these openings a nipple is screwed fitted with an elbow at the top and with a tee at the bottom. Into this elbow and tee a piece of pipe is turned which carries the water column and steam gauge, as shown in the cuts of boiler in first part of catalogue illustrating steam trimmings.

The section just back of the front section has only one opening to which the damper regulator is connected. This damper regulator is fitted with a diaphragm which acts according to the amount of steam pressure carried and the lever arm has a certain number of weights which are raised or lowered according to the pressure. To this lever arm a chain is attached which in turn connects with the damper door on the base of the boiler. When the desired steam pressure is reached, according to the number of weights placed on the lever arm, the draft door will close. The steam pressure exerted on the diaphragm raises the weights on the lever and allows the door to drop in position. When this steam pressure is lowered the weights on the lever arm pull on the chain and open the draft door again so the fire will burn briskly and steam will be raised to a higher pressure. This feature in the steam boiler is very desirable, as it insures even pressure at all times.

How to Erect Sectional Boilers.



Smoke Ell Sent With Every Boiler With Patent Ratchet Damper Control.

As stated before, we believe, we have the only boiler on the market with a flexible fire travel. The small oval shaped plates furnished with the boiler are called baffle plates and are made to fit in the side flue between the sections. If you have good draft place one of these baffle plates in each side flue between each section in the boiler except between the back section and the one next to it. If your draft is poor take out some of the baffle plates beginning in the rear. By using these baffle plates you will be able to give your boiler the proper fire travel required for the chimney unless the conditions are extreme. After baffle plates are in position and you have found out the number needed to give perfect draft it is a good idea to cement around them with boiler cement the same as you used between the sections. These plates can be put in from the back of the boiler as well as from the front. But in most sizes all of the openings in the side flues can be reached through the front flue doors.

The next thing to be done is to attach the smoke ell to the rear section. On each side of this smoke ell there are two slotted openings which you will find come directly opposite the two tapped openings in the rear section of the boiler. There are small stove bolts which fit into these openings and smoke ell is attached to the section with these bolts.

This smoke ell is fitted with a damper and on the left hand side from the front of the boiler there is a ratchet attachment designed so that damper can be set in any position desired. Be sure this ratchet attach-

How to Erect Sectional Boilers.

ment when in the last notch is carefuly made fast to the shaft or rod that passes through the damper and that damper is wide open. When ratchet is moved up to the first notch the damper should be almost closed. Make a note of this so you will remember the position the damper is in by looking at the notch on the ratchet. On the opposite side of the smoke ell is a check draft for use in case of emergency and for cleaning. In our large sizes damper is connected to a long rod extending the length of the boiler and fastened on the side of the front section. A ratchet handle is then provided so damper can be operated from the front and set as desired. It is a good idea to clean out the smoke ell occasionally or burn it out. In addition to this damper in the smoke ell you should have a damper in the pipe that leads from the boiler to the chimney, for draft can be controlled and regulated to far better advantage with two dampers than it can with one. With two dampers you will have a chance to make your chimney draw perfectly while with one damper you will have a chance to make it draw only one-half as well as it should. Many people do not use two dampers as they do not understand the principle of it but if you will put them in we feel satisfied in a short time you will see the advantage.

Boiler should be set as close to chimney as possible for this improves the draft and is in every way preferable to long smoke pipe connection.

In making connection to chimney be careful that smoke pipe does not extend too far into the flue, thus lessening the area of the smoke passage at this most important point. The smoke and gases from the boiler as they enter the chimney should have the full space the flue way provides in order that they may readily change their course.

For further information about this matter read article about Chimneys in another part of this book.

Boiler Sense Boiled Down

Boilers and Shoes Compared.

There are just as many different grades of boilers as there are shoes. You can buy a pair of shoes for $2.00 or you can pay $10.00 a pair for them. Now, there must be *some real reason* why one particular boiler is better than *another,* there must be some *real reasons* why one particular boiler is worth more money than other *boilers* and we are going to try to show you how to decide this boiler question properly for yourself.

The things to be considered in buying a boiler are these:

SIMPLICITY	ABSENCE OF TROUBLE
EFFICIENCY	SMALL REPAIR BILLS
DURABILITY	FUEL CONSUMPTION
ESTABLISHED REPUTATION	ECONOMY OF OPERATION

Simplicity in Design, Construction and Operation.

SIMPLICITY. All parts operated from the front. Only three flueways in the entire boiler which makes possible the long fire travel, perfect combustion, easy cleaning, and perfect draft. Only six doors and all fastened independent of the boiler—not screwed into the section. Balanced grates, no locks, catches or latches. Gravity locked grate connecting rods with no bolts, cotter pins or rivets. Ratchet damper that sets at any desired notch you wish and gives perfect draft control. Push nipple construction with iron to iron joint. No headers, or screwed nipples, no flanges, no gaskets, no short twisted tie bolts. Four tie bolts for one boiler—not 20 to 80 little machine bolts pulling boiler one way and another. And there is more, but take our word for it the boiler is simplicity itself, or write and we'll tell you the rest of it.

Heat in the Greenhouse and Coal in the Bin—That Is Efficiency.

EFFICIENCY. Built on the "Chain" principle, the latest and most successful principle in boiler building. Each column of water giving rapid and positive circulation. Every section on each side of the fire-pot extends inwardly in the shape of a wedge, presenting a very thin column of water to the direct action of the fire. This heated water immediately rises in the center water columns dividing the flueways and passes over the heated surfaces of the flues into the flow main and through the system. The excess over what the flows will take spreads out in the upper dome of the section and falls around the outer flue chain link, thence to the bottom of the outer leg of the section where the water from the returns is coming in. Here it again flows into the wedge next to the fire and is

Boiler Sense Boiled Down

started on its way to the flow pipe. Every part of the fire backed by water using every possible unit of heat. A flexible fire travel that extends three times the boiler's length and twice its width or in case of poor draft, can be cut down to twice the boiler's length and twice across. Because of flexible fire travel boiler can be adapted perfectly to your chimney. All heating engineers are agreed that boiler and chimney must both work as one unit to give best results. The only boiler with this wonderful feature.

One Boiler, One Bill to Pay—Durability.

DURABILITY. Made in a foundry that has been making greenhouse boilers since 1868. Made of Cast-Iron, the metal that lasts longest. Iron used is of the best quality to be had. All parts tested and assembled at the factory. Guaranteed to last a lifetime without repairs if properly cared for. Grates alone will give out and then only from carelessness. Boilers installed in 1869 still in use in 1912.

The Power Back of the Boiler—Our Reputation.

ESTABLISHED REPUTATION. For 35 years the Furman boiler was made and sold for greenhouse heating. It heated more glass than any other make of boiler on the market and was used from coast to coast. Recognizing the merit of the boiler we at once selected it as the best for our customers. Knowing greenhouse conditions and greenhouse needs, we began to improve the boiler along the line of our ideas. The old Herendeen Company, that made the original Furman, no longer exists, being merged with another corporation, but the boiler is still here and it will stand for years to come on its reputation. The Moninger-Furman, the improved type, is today one of the best known greenhouse boilers in this country and is being rapidly adopted in Germany, France, England and Canada.

It's Just the Same as Money—Read This Trouble Talk.

ABSENCE OF TROUBLE. With boilers, troubles are often as numerous as the sands of the sea. Our boiler has few parts, we believe the fewest parts of any Cast-Iron boiler made, hence less chance for trouble. The iron to iron joints when once together tight never leak, yet boiler can at any time be taken apart. Cast in an up-to-date foundry by modern methods sections come out true in shape and thickness. Cracked section troubles practically eliminated. No flues to leak and plug. No night and day job constantly ramming and cleaning flues clogged with soot. No weak back plate to give out. No flues to replace every two or three years. No brick work to do. No headers to leak and crack. No gaskets to burn out. No flanges to pack and keep tight. No need to buy a new boiler every time you add to your glass—add sections. Keeps fire longer

Boiler Sense Boiled Down

on account of the deep fire-pot. Less coal to put in, less ashes to take out. Gives fireman more time for work or rest. Requires less space and thus makes boiler room convenient for other work.

No Wonder Some Boilers Are Expensive.

SMALL REPAIR BILLS. The Grates are the only parts to wear out. Grates warp or burn in every type of boiler if fire and ash-pit is not kept clean. Absolutely the only repairs needed in a lifetime if boiler is given ordinary care, the same as you would give any other boiler. Nothing to give out as every part is Cast-Iron. Not a steel piece in the whole boiler. Grate castings are cheap and hence the repair bill will be a small item.

Many a Hard Earned Dollar Spent for Coal Wasted.

FUEL CONSUMPTION. The deep fire-pot and the flexible travel keeps the heat in boiler and the coal in the bin. A deep steady fire burns slow, throws intense heat and gives time for perfect combustion and absorption of the heat units contained in the heated gases thrown off by the coal. The flexible fire travel can be adjusted to meet conditions of your chimney and insures proper volume of air passing up through the grates at the right speed.

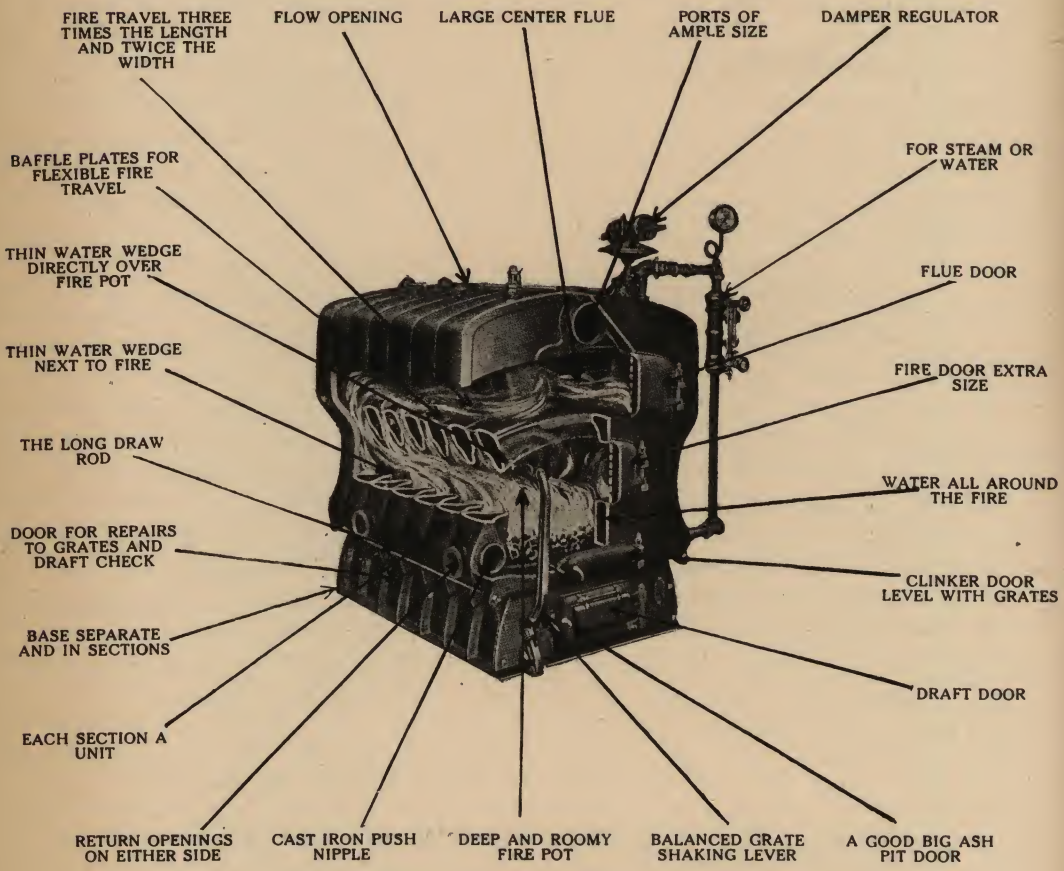
The fire and the draft absolutely under control makes for the greatest fuel economy. Grates are properly proportioned. Combustion chamber ample in size. Flueways large and roomy to provide additional combustion space and to provide for the maintenance of a high temperature for burning the air. Grates figured to admit air in the ratio of thirteen to one compared to gases given off by coal when boiler has proper fuel charge. This ratio accepted by heating authorities everywhere as standard.

And After All the First Cost Is But Very Little More.

ECONOMY OF OPERATION. This refers to labor and time required to care for the boiler. The less fuel burned, the less coal to handle, the less ashes to remove and the more time for other work. The deep fire-pot keeps fire with soft coal as long as eight hours which in a small place means one man can do all the work if necessity demands it. There are no parts to constantly tinker with. No time is wasted making numerous repairs as there are none to make. No labor is spent in hard firing to get through a cold snap as every boiler sold, will under ordinary firing, work up to its full rated capacity and more. With a larger volume of water exposed to the direct action of the fire, boiler will operate in moderate weather with less fuel than any type we know of.

We are not trying to *persuade* you to buy a Moninger Boiler; we are trying to *convince* you that it is a good boiler, and the only one you ought to buy. *And it is really a wonderful boiler.* This remains a fact whether you buy one or not.

Boiler Sense Boiled Down



The above illustrates nearly all we have tried to explain to you. Study this picture carefully. Think it over for yourself. Don't take our word for it, although our word is good any time we give it, do your own figuring and thinking. Honestly though, can you go another winter without this boiler?

Estimates Cheerfully Furnished for Complete Systems

How to select your Boiler

The kind of fuel you are going to use has much to do with the size of the boiler to purchase, for some grades of coal will do better in certain styles of boilers than others. As a general rule boilers are figured with hard coal as a basis and when used for soft coal you must get a larger boiler. Hard coal can be burned in most any style of fire-pot while a comparatively long and narrow fire-pot is best adapted to soft coal. Our boilers are especially designed for burning soft coal, either block or run of mine.

If you are going to use soft coal, select a boiler that is at least 25% larger than actually required for the work. If you find, after figuring all roof glass, glass in sides and ends, and after reducing all concrete and woodwork to glass equivalent (for which you will find rules in another part of this book), that you have a total of say 12,000 feet of glass, select a boiler that will heat 15,000 sq. ft. of glass to the temperature desired. This working surplus for a boiler will insure economical results and it will be an advantage in many ways. With the extra capacity you will be able to get the desired temperature in the greenhouse without keeping a high water temperature at the boiler.

With a low water temperature at the boiler you will not need to fire as hard or as often and consequently there will be a saving in fuel and in labor firing and removing ashes.

Another advantage is that in extreme weather your boiler can be operated at a high water temperature and heat carried to the greenhouse to take care of the low outside temperature. Another advantage is the boiler will last longer for it is subject to less strain when operated with a low water temperature than it is when continually forced.

Be careful, though, not to have the boiler too large, for while a mistake of this kind is not as serious as that of having boiler too small, it is nevertheless not desirable. If boiler is too large you are obliged to use a great quantity of coal to hold fire and cover grate surface. Capacity, however, 50 to 75% in excess of that need is not too much margin. With this extra surplus your boiler will work to good advantage and especially is this true of a high pressure mercury system. With a mercury generator it is always desirable to have boiler about 50% larger than actually necessary.

If you will refer to Boiler Tables you will find the number of sq. ft. of glass specified that each boiler will heat to various temperatures.

How to blow off a Steam Boiler

A steam boiler should be blown off within one week after it is in operation, to remove the unavoidable accumulation of oil, grease etc., that have a tendency to cause a boiler to foam, preventing the generation of steam and causing an unsteady water line. This can only be done when the boiler is under pressure. If one blowing off does not result in a steady water line and clean gauge, the operation must be repeated a second, or, if necessary, a third and fourth time.

1. Attach a blow-off cock to the boiler at lowest point possible.

2. Close all valves, or, if the mains are valved, close both flow and return valves tightly, and also close the cock below the diaphragm regulator on boiler.

3. With a wood fire and boiler filled to center of water glass, get up a pressure of not less than 10 to 12 pounds by the steam gauge.

4. Open the blow-off cock, being careful that sufficient fire is carried to maintain a pressure until the last gallon of water is blown out.

5. Draw any remaining fire and open all fire and flue doors wide.

6. Allow the boiler to cool down, which will probably take from one-half to one hour, then close the blow-off cock and slowly fill boiler to water line.

7. Open all valves on flow and return lines, the diaphragm cock and also the radiator valve.

8. Rebuild fire.

9. Repeat the operation until there is a steady water line and a clean gauge glass.

Price List, Repair Parts, Moninger Boilers

Name of Parts	Serial Numbers				
	180	220	270-G 270	330	380
Front Section	$20.80	$28.20	$37.10	$46.30	$81.20
Reg. Intermediate Section	19.70	27.40	37.00	42.20	74.20
Special Tapped Section next front	18.80	27.40	35.30	42.50	70.90
Special No-Tap Section					70.90
Reg. Interm'e Sec. Tapped	20.40	27.80	37.50	42.80	73.70
Back Section	22.50	30.90	43.80	50.20	91.10
Front Base Plate	1.45	1.75	2.40	3.00	5.35
Front Base Plate				3.00	
Side Base Plate with door					5.65
Side Base Plate (1 grate)	.75	.75	.85	.85	1.50
Side Base Plate (2 grate)	1.90	1.90	2.60	2.55	3.15
Side Base Plate (3 grate)				3.50	4.15
Side Base Plate (4 grate)	2.80	2.80	4.00	4.75	5.90
Corner Base Plates					1.15
Back Base Plate	1.80	2.45	3.00	4.35	4.35
Back Base Plate, covering plate					.90
Base Plate Cap open	.30	.30	.30	.30	.30
Base Plate Cap closed			.30	.30	.30
Connecting Bar guides on Bases over 4 grates	.30	.30	.30	.30	.30
Ash Pit Door	1.00	1.00	1.15		1.75
Ash Pit Door, M. S. or N. S.				1.25	
Draft Door (New Style)				.90	
Draft Door	.40	.40	.40	.40	1.00
Draft Door Ratchet	.30	.30	.30	.30	.30
Draft Door on base side					1.25
Grate Bar, front or rear half	.40	.50	.70	.85	.90
Grate Bar, Intermediate	.90	1.30	1.50	1.90	5.10
Grate Bar, Intermediate new style				3.00	
Base Grate Lug	.30	.30	.30	.30	
Base Front Connecting Bar	.30	.30	.40	.40	.60
Connecting Bar 2 grate	.40	.30			
Connecting Bar 3 grate	.40	.40	.40		
Connecting Bar 4 grate	.50	.50		.60	
Connecting Bar 3 grate N. S.				.50	.50
Connecting Bar 4 grate N. S.				.60	.60
Connecting Bar 5 grate N. S.				.80	.80
Connecting Bar 1 grate (extension)	.30	.30	.30	.30	
Connecting Bar 2 grate	.30	.30	.30	.30	
Connecting Bar 3 grate			.40	.40	
Shaker Handle	.60	.60	.75	.75	1.10
Fire Door	1.00	1.10	1.15	1.75	2.25
Fire Door Lining	.70	.75	.90	1.25	1.70
Fir Door Damper Wheel	.30	.30	.30	.30	.30
Fire Door Hinge Lugs			.30	.30	
Fire Door, N. S.				2.00	
Fire Door Lining, N. S.				1.25	
Fire Door Frame, N. S.				1.50	
Clinker Door	.60	.60	.60	.90	1.00
Clinker Door Lining	.35	.40	.40	.40	.50
Clinker Door Plate	.65	.75	1.00	1.15	1.40
Clinker Door N. S.				1.25	
Clinker Door Lining N. S.				.50	
Clinker Door Frame, N. S.				1.25	
Clinker Door Plate, N. S.				1.25	
Clinker Door Hinge Lug			.30	.30	
Cleanout Door R. or L.	.75	.80	.80	1.40	1.00
Cleanout Door Lining, R. or L.	.35	.55	.55	1.15	.65
Cleanout Door, R. or L. (New Style)				1.00	
Cleanout Door Lining, R. or L. (New Style)				.50	
Cleanout Door Frame, R. or L. (New Style)				1.15	1.00
Center Cleanout Door					1.70
Center Cleanout Door Lining					1.15
Center Cleanout Door Frame					1.70
Cleanout Door Lugs			.30	.30	
Door Catches			.30	.30	
Smoke Ell, Right hand	1.65	2.00	2.75	3.65	5.35
Smoke Ell, Left hand	2.00	2.40	3.00	3.90	6.50
Smoke Ell, Damper	.45	.50	.65	.85	1.75
Smoke Ell, Complete	4.75	5.75	7.00	9.75	18.00
Smoke Ell, Check door	.30	.30	.30	.50	.50
Check Door Frame	.30	.50	.65	.65	.65
Check Door Ratchet	N. C.	N. C.	N. C.	N. C.	
Smoke Box Cap					2.60
Damper Rod					.30
Damper Rod Lever					.30
Back Damper Rod Clip					N. C.
Damper Connecting Rod					.50
Front Damper Gauge Clip					N. C.
Damper Adjustment Handle					N. C.
Damper Handle and Ratchet	.30	.30	.30	.30	
Coil Plate	.30	.30	.30	.30	.30
Baffle Plate	.30	.30	.30	.30	.30
Water Back	1.10	1.10	1.10	1.10	1.10
Water Bottle	1.00	1.00	1.00	1.00	1.00
Water Bottle Connections	.80	.80	.80	.80	.80
Water Column	1.20	1.20	1.20	1.20	1.20
Water Column Connections	1.50	1.50	1.50	1.75	2.00
Diaphragm	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.50	.50
Diaphragm Weight Small	.30	.30	.30	.30	.30
Diaphragm Weight Large	.50	.50	.50	.50	.50
Number Plate	N. C.	N. C.	N. C.	N. C.	N. C.
Diaphragm Complete	5.10	5.10	5.10	5.30	5.30
Diaphragm Rubber	1.00	1.00	1.00	1.00	1.00
Steam Trimmings Complete	8.75	8.75	8.75	10.00	12.00
2-Inch Push Nipple	.30				
3-Inch Push Nipple		.40			
4-Inch Push Nipple	.40	.40	.40	.40	.40
6-Inch Push Nipple			.60	.60	.60
4-Inch Draw Clamps Each			1.00	1.00	1.00
6-Inch Draw Clamps Each			1.50	1.50	1.50
Set 4 Tie Rods 4 Sec.	.80				
Set 4 Tie Rods 5 Sec.	1.00	1.00			
Set 4 Tie Rods 6 Sec.	1.10	1.10	1.30		
Set 4 Tie Rods 7 Sec.	1.30	1.30	1.30	1.30	2.25
Set 4 Tie Rods 8 Sec.		1.40	1.40	1.60	2.50
Set 4 Tie Rods 9 Sec.			1.60	1.90	2.90
Set 4 Tie Rods 10 Sec.				2.00	3.20
Set 4 Tie Rods 11 Sec.					3.50
Flue Brush	.60	.60	.60	.60	.60
Flue Brush Handle	.40	.40	.40	.40	.40
Poker	.50	.50	.50	.75	.75
Hoe	.40	.40	.40	.60	.75

All above Series have two less grate bars than number sections and a front and rear half stationary bar.

The entire front section and all parts on front of boiler as well as grates and connecting bars were changed January 1st, 1911 on 330 series.

A change also made from solid door lugs and catches to loose pattern on 270 and 330 Series.

When ordering repairs it is positively necessary that Serial Number and Size Number be given as well as an accurate description of parts wanted.

Price List, Repair Parts, Moninger Boilers

Name of Parts	Serial Numbers				
	50E	90A	320	230	WN270
Front Section	$24.20	$30.60	$51.30	$52.00	. .
Plain Middle Section	18.20	26.80	41.80	49.00	. .
Plain Middle Section, Tapped	18.60	26.80	42.20	51.00	. .
Middle Next Back	18.10	. .	. .	46.00	. .
Next Back Section, Tapped	18.40	. .	. .	47.00	. .
Bridge Wall Section	. .	. .	49.50	. .	. .
Back Section	25.90	34.90	47.80	57.00	. .
Front Section, R. or L.	. .	. .	. .	. .	46.40
Plain Middle Section, R. or L.	. .	. .	. .	. .	49.00
Plain Middle Section, Tapped, R. or L.	. .	. .	. .	. .	49.30
Middle Next Back Section, Tapped, L. H.	. .	. .	. .	. .	48.30
Middle Next Back Section, Plain, R. H.	. .	. .	. .	. .	47.60
Middle Section Tapped, ¾-inch	. .	. .	. .	. .	49.30
Back Section, R. or L.	. .	. .	. .	. .	54.00
Strip Closing	. .	. .	. .	. .	.80
Ashpit Door	2.35	2.35	3.15	2.75	3.15
Ashpit Flap Door	.30	.30	.65	.75	.75
Ashpit Flap Door, N. S.	. .	. .	. .	.30	. .
Ashpit Door Slide	.30	.30	.30	.30	.30
Ashpit Door Handle	.30	.30	.30	.30	.30
Ashpit Door Catch	N. C.	N. C.	N. C.	N. C.	N. C.
Base Front	1.70	2.40	2.95	5.75	10.15
Base Back	2.30	2.50	3.80	3.45	7.40
Base Back Covering Plate	.30	.35	.35	.35	.90
Base Back Plate Catch	N. C.	N. C.	N. C.	. .	.30
Back Corrugated Plate	. .	. .	4.10	. .	. .
Back Plain Plate	. .	. .	5.60	. .	. .
Base Side, Blank, 1 Extension	. .	. .	1.05	. .	2.10
Base Side, Blank, 2 Extension	. .	. .	. .	2.40	4.50
Base Side, Blank, 3 Extension	. .	. .	. .	3.70	6.10
Base Side, Blank, 4 Extension	3.15	3.20	. .	4.50	8.50
Base Side, Blank, 5 Extension	4.15	3.50	. .	. .	10.15
Base Side, Blank, 6 Extension	4.65	4.45	4.50	. .	. .
Base Side, Blank, 7 Extenson	5.30	4.90	5.20	. .	. .
Base Side, Blank, 8 Extension	6.20	6.50	6.00	. .	. .
Base Side, Blank, 9 Extension	7.30	7.10	6.80	. .	. .
Base Side, Blank, 10 Extension	. .	. .	8.00	. .	. .
Base Side Plate Draft Opening 4 Section	2.85	. .	. .	3.70	. .
Base Side Plate Draft Opening 5 Section	4.00	. .	. .	. .	8.30
Base Side Plate Draft Opening 6 Section	4.35	. .	. .	. .	. .
Base Side Plate Draft Opening 7 Section	5.45	. .	. .	. .	. .
Base Side Plate Draft Opening 8 Section	6.00	. .	. .	. .	. .
Base Side Plate Draft Opening 9 Section	7.20	. .	. .	. .	. .
Base Side Draft Door	.35	. .	. .	.70	1.25
Base Side Draft Door Frame	.75	. .	. .	1.90	4.60
Grate Middle	.90	1.75	2.30	3.20	6.00
Grate One-half Stationary	.60	.80	1.90	1.20	2.20
Grate Middle A Style	. .	1.20	. .	. .	. .
Grate One-half Stationary, A Style	. .	.40	. .	. .	. .
Grate Rest per Section	. .	.25	.25	. .	. .
Grate Lock	. .	. .	. .	.30	.30
Short Connecting Bar	.30	.30	.30	.50	.60
Long Connecting Bar per Grate	.20	.20	.20	.30	.30
Front Short Connecting Bar	.30	. .	.30	.50	. .
Shaker Shank	.35	.35	.30	.90	1.20
Shaker Fulcrum	.30	.30	.30	.40	.50
Shaker Handle	.50	.50	.50	.50	.50
Fire Door	1.50	2.20	2.25	2.25	. .
Fire Door Frame	2.85	2.65	2.15	. .	1.90
Fire Door, R. or L.	. .	. .	. .	. .	2.50
Fire Door Liner, R. or L.	. .	. .	. .	. .	.70
Fire Door Liner	1.00	1.00	.85	1.00	. .
Fire Door Wheel	.30	.30	.30	.30	.30
Fire Door Catch	. .	. .	. .	N. C.	N. C.

Name of Parts	Serial Numbers				
	50E	90A	320	230	WN270
Fire Door Handle	.30	.30	.30	.30	.30
Fire Door Hinge Plate	. .	. .	. .	.50	.50
Clinker Door, R. or L.	. .	. .	. .	.50	.65
Clinker Door Liner, R. or L.	. .	. .	. .	.40	.50
Clinker Door Handle	. .	. .	. .	.30	.30
Cleanout Door	2.40	2.75	. .	. .	. .
Cleanout Door Frame	2.40	2.40	. .	. .	. .
Cleanout Door Liner	1.50	1.25	1.40	. .	. .
Cleanout Door Large, R. or L.	. .	. .	2.50	1.80	6.00
Cleanout Door Small, R. or L.	. .	. .	. .	. .	1.65
Cleanout Door Liner Small, R. or L.	. .	. .	. .	. .	.75
Cleanout Door Hinge Plate, Large	. .	. .	. .	.50	.50
Cleanout Door Hinge Plate, Small	. .	. .	. .	.40	.40
Cleanout Door Handle	.30	.30	.30	.30	.30
Cleanout Door Catch	. .	N. C.	N. C.	N. C.	N. C.
Hinge Pin Knob	N. C.	N. C.	N. C.	N. C.	N. C.
Baffle Plate Front	. .	. .	. .	. .	.60
Baffle Plate, R. H. or L. H., (Old Style)	. .	.30	. .	. .	. .
Smoke Box Blank	2.25	3.00	. .	3.00	7.20
Smoke Box with Check Opening	2.15	2.70	9.00	2.70	7.00
Smoke Box Check Frame	. .	. .	.60	.70	. .
Smoke Box Lid	.30	.35	.35	.35	.80
Smoke Box Damper	.50	.75	1.00	.75	3.25
Smoke Box Damper Connection	.30	.30	.30	.30	.30
Smoke Box Damper Handle	. .	N. C.	N. C.	N. C.	1.30
Smoke Box Cap	. .	1.85	. .	1.80	. .
Smoke Box Collar 10 or 12 inch	. .	1.20	. .	. .	. .
Smoke Box Seg, Gauge Ful'm	.30	.30	.30	.30	.30
Smoke Box Segment Gauge	.30	.30	.30	.30	.30
Smoke Box Seg. Gauge Catch	.30	.30	.30	.30	.30
Indirect Damper	. .	1.10	. .	. .	. .
Water Column	. .	. .	. .	3.50	3.50
Water Column Connection	. .	. .	. .	2.00	2.00
Diaphragm	3.00	3.00	3.00	3.00	3.00
Diaphragm Lever	.30	.30	.30	.50	.50
Diaphragm Weight, Large	. .	. .	.50	.50	.50
Diaphragm Weight, Small	.40	.40	.40	.40	.40
Diaphragm Connection Pipe	.30	.30	.30	.40	.40
Diaphragm Rubber	1.00	1.00	1.00	1.00	1.25
Diaphragm Complete	5.00	5.00	5.50	5.80	6.05
Steam Trimmings Complete	8.75	8.75	10.00	10.00	12.00
Number Plate	N. C.	N. C.	N. C.	N. C.	N. C.
Name Plate	.30	.30	.30	.30	1.00
Nipple 4-inch—C. I.	. .	. .	. .	.50	.50
Nipple 5¼-inch C. I.	. .	. .	. .	.60	.60
Nipple 3-inch Steel	.30	.30	.30	. .	. .
Nipple 4-inch Steel	. .	. .	.30	. .	. .
Washer Large, Square	. .	. .	. .	.75	.75
Washer Oval	. .	. .	. .	.40	.40
Washer Medium per ½ Dozen	.30	.30	.30	.30	.30
Washer 2½-inch, per ¼ Doz.	. .	. .	. .	.30	.30
Washer 2-inch, per ½ Doz.	. .	. .	. .	.30	.30
Washer, Small, per ½ Doz.	.30	.30	.30	.30	. .
Washer, Large	.30	.30	.30	. .	. .
Thumb Screw	N. C.	N. C.	N. C.	N. C.	N. C.
Thumb Latch	N. C.	N. C.	N. C.	N. C.	N. C.
Sets 4 Tie Rods 4 Secs.	.70	. .	. .	. .	. .
Sets 4 Tie Rods 5 Secs.	.90	1.00	. .	1.20	. .
Sets 4 Tie Rods 6 Secs.	1.00	1.10	1.20	1.40	2.00
Sets 4 Tie Rods 7 Secs.	1.20	1.30	1.30	1.60	2.25
Sets 4 Tie Rods 8 Secs.	. .	1.40	1.40	1.80	2.50
Sets 4 Tie Rods 9 Secs.	. .	1.60	1.60	2.00	2.90
Sets 4 Tie Rods 10 Secs.	. .	. .	. .	2.20	3.20
Sets 4 Tie Rods 11 Secs.	. .	. .	. .	. .	3.50
Sets 4 Tie Rods 12 Secs.	. .	. .	. .	. .	3.80
Hoe	.50	.50	.50	1.00	1.25
Poker	.50	.50	.50	1.25	1.50
Flue Brush	.75	.75	.75	1.00	1.20
Flue Brush Handle	.40	.40	.40	.60	.60

This Series has 3 Rods in Set.
The 50E Series has one less middle grate bar than number of sections and a front and rear half bar.
The (90A and 320) Series have two less intermediate grate bars than number of sections and a front and rear half bar. The (230 and WN270) Series have one less intermediate grate bar than number of sections and a front half bar.
NOTE—20-inch grate 50A, 50B and 550 Series same as 50E Series except grates and shaker attachments. 500 and 530 Series same as above except having plate front and back. 20 Series same as 50E Series.
24-inch grate.
70 Series (without 1904) same as 90A Series except having plate front and back. 70 Series (with 1904) same, with water front and back. C. O. doors same but fire door larger on plate front.
90 and 90A Series are the same except latter has double shake over six sections.
24 and 24B Series same as 90 and 90A Series Sunray.
32-inch grate.
80 Series (without 1904) same as 320 Series except having plate front and back, 80 Series (with 1904) same, with water front and back. C. O. doors same but fire door larger on plate front. 800 Series same as 80 Series dated 1904, also same as 320 Series except slight difference in intermediate section, although interchangeable.
32B Series same as 800 Series.
32 Series same as 320 Series.
Letters found with size numbers of Boilers indicate some change and should always be given when ordering repairs.

Pipe, Fittings, Valves, etc.

In presenting this catalog to the trade, we have endeavored to furnish as completely as a book of this size will permit, all the general information necessary in readily selecting goods to meet the majority of requirements.

We have purposely avoided going into lengthy and confusing details, regarding unimportant dimensions and much other subject matter, that in most cases, can be better and more clearly handled by correspondence and special circulars.

Our many customers will understand that we are prepared to take care of their needs promptly and satisfactorily along this line. We carry a complete line, of the goods shown, in stock at Chicago and are in a position to fill orders on short notice. We are also prepared to cut and thread large sizes of pipe and make up headers, mains, etc., complete from drawings. Estimates cheerfully furnished.

TERMS.

2% 10 days; net 30 days, or cash unless otherwise agreed on.

Prices subject to change without notice.

No claims allowed unless made within ten days of receipt of goods.

Contracts subject to strikes, accidents or other causes beyond our control.

No goods taken back without first obtaining our consent to return.

All defective goods will be replaced.

No charges for labor or expense required to repair defective goods, or occasioned by them, will be allowed. If the goods are defective, the measure of the damage is the price of the defective goods only.

Carriers are responsible for all goods damaged or lost in transit.

For terms on pipe see pipe list.

Be careful to give figure numbers when shown and state sizes and styles wanted clearly. This will help eliminate mistakes.

STANDARD STEAM, GAS AND WATER PIPE

Black and Galvanized.

Nominal Inside Diameter	Actual Outside Diameter	Price Per Foot	Nominal Thickness	Nominal Weight per Foot	Number of Threads per Inch of Screw
⅛	0.40	$0.05½	.068	.245	27
¼	0.54	.06	.088	.425	18
⅜	0.67	.06	.091	.568	18
½	0.84	.08½	.109	.852	14
¾	1.05	.11½	.113	1.134	14
1	1.31	.17	.133	1.684	11½
1¼	1.66	.23	.140	2.281	11½
1½	1.9	.27½	.145	2.731	11½
2	2.37	.37	.154	3.678	11½
2½	2.87	.58½	.203	5.819	8
3	3.5	.76½	.216	7.616	8
3½	4.00	.92	.226	9.202	8
4	4.5	1.09	.237	10.889	8
4½	5.00	1.27	.247	12.642	8
5	5.56	1.48	.258	14.810	8
6	6.62	1.92	.280	19.185	8
7	7.62	2.38	.301	23.769	8
8	8.62	2.50	.277	25.000	8
9	9.68	3.45	.342	34.188	8
10	10.75	3.20	.279	32.000	8
11	11.75	4.63	.375	46.247	8
12	12.75	4.50	.330	45.000	8

Unless otherwise ordered, black pipe, random lengths, with thread and coupling, will be shipped.

For cut lengths an extra charge will be made above random lengths.

For pipe smoothed on the inside, known as plugged and reamed, an extra charge will be made above regular pipe.

For galvanized pipe an extra charge will be made above black.

For asphalted pipe an extra charge will be made above black.

EXTRA STRONG STEAM, GAS AND WATER PIPE

Card weight subject to the usual variation of 5 per cent.

Size, Inches	Nominal Outside Diameter	Nominal Inside Diameter	Nominal Thickness	Nominal Weight per Foot	Price per Foot
⅛	.405	.215	.095	.314	$ .12
¼	.540	.302	.119	.535	.07½
⅜	.675	.423	.126	.738	.07½
½	.840	.546	.147	1.087	.11
¾	1.050	.742	.154	1.473	.15
1	1.315	.957	.179	2.171	.22
1¼	1.660	1.278	.191	2.996	.30
1½	1.900	1.500	.200	3.631	.36½
2	2.375	1.939	.218	5.022	.50½
2½	2.875	2.323	.276	7.661	.77
3	3.500	2.900	.300	10.252	1.03
3½	4.000	3.364	.318	12.505	1.25
4	4.500	3.826	.337	14.983	1.50
4½	5.000	4.290	.355	17.611	1.80
5	5.563	4.813	.375	20.778	2.08
6	6.625	5.761	.432	28.573	2.86
7	7.625	6.625	.500	38.048	3.81
8	8.625	7.625	.500	43.388	4.34
9	9.625	8.625	.500	48.728	4.90
10	10.750	9.750	.500	54.735	5.48
11	11.750	10.750	.500	60.075	6.10
12	12.750	11.750	.500	65.415	6.55

Extra Strong and Double Extra Strong will be shipped in random lengths and plain ends unless otherwise ordered.

For pipe fitted with threads and couplings an extra charge will be made above regular.

For cut lengths an extra charge will be made above random.

For galvanized or asphalted an extra charge will be made above black.

PIPE TRADE CUSTOMS

Quotations subject to change without notice. Sales subject to strikes, accidents or causes beyond our control.

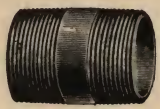
Every piece of Pipe, Tubing, Casting, Boiler Tube, Line pipe, etc., is carefully tested, but as it is impossible to always detect imperfections, the only guarantee that is given is to replace such goods as prove defective. Under no circumstances are we responsible for any damages beyond the price of the goods. No charges for labor or expense required to repair defective goods or occasioned by them will be allowed. If the goods are defective, the measure of damages is the price of the defective pieces.

Claims for shortage or deductions for erroneous charges must be promptly presented or will not be allowed.

Special goods made to specification, where buyer is to inspect, must be inspected and accepted before shipment is made. After shipment is made our responsibility ceases.

WROUGHT IRON NIPPLES

CLOSE
FIG. 50.



SHOULDER
FIG. 51.

TABLE OF SIZES AND LENGTHS KEPT IN STOCK

LENGTH, INCHES.					SIZE, INCHES.	PRICES.		PRICE OF EXTRA LONG NIPPLES. INCHES.								
Close.	Short.	Long.				Close or Short.	Long.	4	5	6	7	8	9	10	11	12
¾	1½	2	2½	3	3½	⅛	.04	.06	.07	.08	.10	.12	.11	.15	.17	.18	.19
⅞	1½	2	2½	3	3½	¼	.04	.06	.07	.08	.10	.12	.14	.15	.17	.18	.19
1	1½	2	2½	3	3½	⅜	.04	.06	.07	.08	.10	.12	.14	.15	.17	.18	.19
1⅛	1½	2	2½	3	3½	½	.05	.07	.08	.10	.12	.14	.16	.18	.20	.22	.23
1⅜	2	2½	3	3½	4	¾	.06	.09		.11	.13	.17	.18	.20	.22	.24	.26
1½	2	2½	3	3½	4	1	.08	.13		.15	.18	.23	.25	.28	.31	.34	.36
1⅝	2½	3	3½	4	4½	1¼	.11	.17		.20	.24	.29	.33	.36	.40	.44	.47
1¾	2½	3	3½	4	4½	1½	.13	.20		.25	29	.36	.40	.45	.50	.54	.59
2	2½	3	3½	4	4½	2	.18	.27		.32	.38	.50	.54	.59	.65	.72	.77
2½	3	3½	4	4½	5	2½	.39	.59			.68	.90	.97	1.06	1.17	1.26	1.35
2½	3	3½	4	4½	5	3	.48	.72			.85	1.08	1.20	1.33	1.45	1.58	1.70
2¾	4	4½	5	5½	6	3½	.75	1.05				1.30	1.45	1.60	1.75	1.90	2.05
3	4	4½	5	5½	6	4	.85	1.20				1.52	1.69	1.87	2.05	2.22	2.40
3	4	4½	5	5½	6	4½	1.25	1.70				2.25	2.50	2.75	2.95	3.17	3.40
3¼	4½	5	5½	6	6½	5	1.55	2.45				2.58	2.83	3.10	3.35	3.60	3.85
3¼	4½	5	5½	6	6½	6	1.85	2.90				3.05	3.35	3.70	4.00	4.30	4.65
3½	5					7	3.20				3.60	4.05	4.45	4.90	5.30	5.75	6.15
3½	5					8	3.55				4.05	4.55	5.05	5.50	6.00	6.50	7.00
4	5					9	5.25						6.50	7.10	7.75	8.40	9.00
4	5					10	6.75						8.25	8.90	9.70	10.40	11.15
4	5					12	8.00						10.00	10.80	11.75	12.70	13.65

Nipples larger than 12 inch made to order and charged as cut pipe, and threads extra.

WROUGHT IRON NIPPLES

PLAIN, RIGHT AND LEFT

TABLE OF SIZES AND LENGTHS

LENGTH, INCHES.						SIZE, INCHES.	PRICES.		PRICE OF EXTRA LONG NIPPLES.								
									INCHES.								
Close.	Short.	Long.					Close or Short.	Long.	4	5	6	7	8	9	10	11	12
⅜	1½	2	2½	3	3½	⅛	.05	.08	.09	.11	.13	.16	.18	.20	.23	.25	.27
⅞	1½	2	2½	3	3½	¼	.05	.08	.09	.11	.13	.16	.18	.20	.23	.25	.27
1	1½	2	2½	3	3½	⅜	.05	.08	.09	.11	.13	.16	.18	.20	.23	.25	.27
1⅛	1½	2	2½	3	3½	½	.07	.10	.11	.13	.16	.18	.21	.24	.27	.29	.31
1⅜	2	2½	3	3½	4	¾	.08	.12		.15	.17	.23	.25	.27	.29	.32	.35
1½	2	2½	3	3½	4	1	.11	.18		.20	.24	.31	.33	.37	.41	.45	.48
1⅝	2½	3	3½	4	4½	1¼	.15	.23		.27	.32	.39	.45	.50	.55	.60	.65
1¾	2½	3	3½	4	4½	1½	.18	.27		.34	.39	.48	.52	.60	.67	.72	.80
2	2½	3	3½	4	4½	2	.24	.36		.43	.51	.67	.72	.80	.87	.96	1.03
2½	3	3½	4	4½	5	2½	.52	.79			.91	1.20	1.30	1.40	1.55	1.68	1.80
2½	3	3½	4	4½	5	3	.65	.96			1.13	1.44	1.60	1.77	1.93	2.10	2.27
2¾	4	4½	5	5½	6	3½	1.00	1.40				1.75	1.95	2.15	2.35	2.55	2.75
3	4	4½	5	5½	6	4	1.15	1.60				2.00	2.25	2.50	2.75	3.00	3.25

ADD 60 PER CENT TO ABOVE PRICES FOR GALVANIZED RIGHT AND LEFT NIPPLES, SPECIAL DISCOUNT ACCORDING TO QUANTITY ORDERED

WROUGHT IRON NIPPLES

GALVANIZED

RIGHT HAND

TABLE OF SIZES AND LENGTHS

LENGTH, INCHES.					SIZE, INCHES.	PRICES.		PRICE OF EXTRA LONG NIPPLES.								
								INCHES.								
Close.	Short.	Long.				Close or Short.	Long.	4	5	6	7	8	9	10	11	12
3/4	1½	2	2½	3	3½	⅛	.06	.11	.12	.15	.17	.21	.24	.26	.29	.31	.34
7/8	1½	2	2½	3	3½	¼	.06	.11	.12	.15	.17	.21	.24	.26	.29	.31	.34
1	1½	2	2½	3	3½	⅜	.06	.11	.12	.15	.17	.21	.24	.26	.29	.31	.34
1⅛	1½	2	2½	3	3½	½	.06	.11	.13	.16	.18	.23	.26	.28	.31	.33	.36
1⅜	2	2½	3	3½	4	¾	.08	.14		.18	.21	.26	.29	.32	.35	.38	.41
1½	2	2½	3	3½	4	1	.11	.19		.24	.28	.34	.38	.42	.47	.51	.55
1⅝	2½	3	3½	4	4½	1¼	.17	.29		.32	.38	.45	.51	.57	.63	.69	.75
1¾	2½	3	3½	4	4½	1½	.21	.35		.39	.46	.55	.63	.70	.77	.84	.91
2	2½	3	3½	4	4½	2	.27	.47		.52	.61	.74	.83	.93	1.03	1.13	1.23
2½	3	3½	4	4½	5	2½	.56	.86			1.00	1.26	1.41	1.56	1.71	1.86	2.01
2½	3	3½	4	4½	5	3	.70	1.10			1.30	1.60	1.80	2.00	2.20	2.40	2.60
2¾	4	4½	5	5½	6	3½	1.20	1.70				2.10	2.35	2.60	2.85	3.15	3.40
3	4	4½	5	5½	6	4	1.35	1.87				2.30	2.60	2.90	3.20	3.50	3.80
3	4	4½	5	5½	6	4½	1.85	2.60				3.30	3.65	4.05	4.45	4.85	5.25
3¼	4½	5	5½	6	6½	5	2.30	3.15				3.75	4.20	4.60	5.00	5.40	5.85
3¼	4½	5	5½	6	6½	6	2.80	4.25				4.50	5.00	5.55	6.05	6.60	7.15
3½	5					7	4.25				4.95	5.65	6.35	7.05	7.75	8.45	9.20
3½	5					8	5.00				5.80	6.65	7.50	8.35	9.25	10.10	10.95

R. AND L. NIPPLES WITH HEXAGON CENTERS

MALLEABLE IRON

FIG. 52.

Size .....Inches	¼	⅜	½	¾	1	1¼	1½	2
Price.....Each	.20	.20	.20	.25	.30	.40	.50	.70

Right Hand Hexagon Nipples made to order at a special price.

LONG SCREWS

WITH COUPLING AND LOCK-NUT FACED

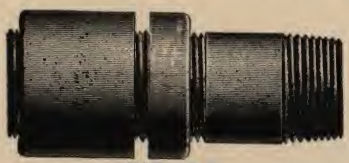


FIG. 53.

Size. .....Inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
Standard Length..Inches	2½	3	3½	4	4½	5	5½	6	7	8	8½	9
Price .....Each	.30	.35	.40	.55	.75	1.00	1.30	1.70	2.70	3.70	5.40	6.60
Price, Galvanized...Each	.35	.40	.50	.66	1.00	1.25	1.60	2.10	3.10	4.70	6.50	7.75

Long Screws, longer than Standard, made to order and charged as CUT PIPE.
Threads, Couplings and Lock-Nuts, extra.
Long Screws made to order from extra heavy pipe.

LOCK-NUT NIPPLES

MADE TO ORDER AND CHARGED AS CUT PIPE, THREADS EXTRA

STANDARD THREADS FOR WROUGHT IRON PIPE

Size.....Inches	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
Price .....Each	.05	.05	.05	.05	.05	.06	.07	.08	.10	.15	.20	.25	.35

Size.....Inches	4½	5	6	7	8	9	10	12	14	16	18	20	
Price .....Each	.45	.55	.70	.85	1.00	1.25	1.50	2.50	3.50	5.00	8.00	10.00	

FIG. 54.

STANDARD
WROUGHT IRON COUPLINGS

Size of Pipe. Inches.	Actual Outside Diameter. Inches.	Length of Coupling. Inches.	Weight of Coupling. Pounds.	No. of Threads per Inch of Screw.	Black. Each.	Galvanized. Each.	Right and Left. Black. Each.	Right Hand. Faced. Each.	Right Hand. Faced. Galvanized. Each.
⅛	13/32	13/16	1/32	27	.05	.06			
¼	17/32	1	1/16	18	.05	.06	.07	.09	.14
⅜	21/32	1 3/32	3/32	18	.06	.08	.08	.10	.15
½	1 3/32	1 5/16	5/32	14	.07	.10	.11	.12	.18
¾	1 7/16	1 9/16	¼	14	.10	.13	.15	.16	.24
1	1 23/32	1 13/16	⅜	11½	.13	.18	.20	.22	.33
1¼	2	1 15/16	9/16	11½	.17	.25	.25	.30	.45
1½	2 9/32	2 3/16	13/16	11½	.21	.32	.30	.40	.60
2	2 13/16	2 5/16	1¼	11½	.28	.40	.50	.50	.75
2½	3 9/32	2 11/16	1⅝	8	.40	.55	.85	.70	1.00
3	4 1/64	3	3 1/16	8	.60	.80	1.20	.90	1.35
3½	4½	3⅛	3¼	8	.80	1.05	1.60	1.20	1.80
4	5 3/32	3⅛	4¼	8	1.00	1.40	2.00	1.50	2.25
4½	5 17/32	3⅛	4¼	8	1.50	2.00		2.10	
5	6¼	3 11/16	6¾	8	1.65	2.25		2.40	
6	7 11/32	3 11/16	8½	8	2.40	3.25		3.60	
7	8 11/32	4 5/16	11½	8	3.25				
8	9 7/16	4 9/16	15¾	8	4.25				
9	10 15/32	5¾	20¾	8	5.50				
10	11½	6¼	26¾	8	7.50				
12	13 25/32	6¼	40½	8	10.00				

FIG. 55.

MALLEABLE IRON COUPLINGS

RIBBED, RIGHT AND LEFT

Size ..... Inches	¼	⅜	½	¾	1	1¼	1½	2
Price, Plain ..... Each	.04	.06	.08	.12	.16	.25	.36	.52
Price, Galvanized ..... Each	.06	.09	.10	.17	.25	.35	.55	.75

FIG. 56.

STEAM AND GAS FITTINGS

ELBOWS

CAST IRON

STRAIGHT

Size .....Inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Price, R. H..... ....Each	.05	.05	.06	.08	.10½	16	.20	.28	.50	.75
Price, R. and L.....Each	.06	.06	.07	.09	.12	.18	.23	.32	.60	.85
Price, R.H., Galvanized.Each	.10	.10	.12	.16	.21	.32	.40	.56	1.00	1.50
Price, Pitched.....Each				.10	.13	.20	.25	.35	.65	1.00

Size .....Inches	3½	4	4½	5	6	7	8	9	10	12
Price, R. H. .....Each	1.05	1.20	1.75	2.00	2.75	4.70	6.75	9.00	13.50	20.00
Price, R.H., Galvanized.Each	2.10	2.40	3.50	4.00	5.50	9.40	13.50	18.00	27.00	40.00
Price, Pitched.....Each	1.30	1.50								

FIG. 57.

REDUCING ELBOWS

CAST IRON

Size .....Inches	½	¾	1	1¼	1½	2	2½	3	3½
Price.....Each	.07	.09	.12	.18	.23	.32	.60	.85	1.20
Price, Galvanized.....Each	.14	.18	.24	.36	.46	.64	1.20	1.70	2.40

Size ..... .Inches	4	4½	5	6	7	8	9	10	12
Price .....Each	1.40	2.00	2.30	3.15	5.40	7.75	10.50	15.50	23.00
Price, Galvanized.....Each	2.80	4.00	4.60	6.30	10.80	15.50	21.00	31.00	46.00

FIG. 58.

45° ELBOWS

CAST IRON

Size .....Inches	⅜	½	¾	1	1¼	1½	2	2½	3	3½
Price ....Each	.06	.07	.10	.12	.19	.24	.34	.60	.90	1.25
Price, Galvanized..Each	.12	.14	.20	.24	.38	.48	.68	1.20	1.80	2.50

Size ....Inches	4	4½	5	6	7	8	9	10	12	
Price .....Each	1.45	2.20	2.50	3.45	5.90	8.50	11.25	17.00	25.00	
Price, Galvanized..Each	2.90	4.40	5.00	6.90	11.80	17.00	22.50	34.00	50.00	

FIG. 59.

ELBOWS

MALLEABLE IRON

STRAIGHT AND REDUCING

Size.....Inches	⅛	¼	⅜	½	¾	1	1¼	1½
Price, R. H.....Each	.06	.07	08	.10	.15	.22	.25	35
Price, R. and L.....Each		.09	.11	.13	.17	.25	.30	.40
Price, Galvanized, R. H.....Each		.09	.11	14	.20	.32	.40	.60

Size.....Inches	2	2½	3	3½	4	4½	5	6
Price, R. H.....Each	.50	.90	1.50	2.25	3.00	3.50	4.00	6.50
Price, R. and L.....Each	.65							
Price, Galvanized, R. H.....Each	.90	1.50	2.60	3.75	5.00			

FIG. 60.

45° ELBOWS

MALLEABLE IRON

Size.....Inches	¼	⅜	½	¾	1	1¼	1½	2
Price.....Each	.08	.10	.12	.18	.26	.36	.54	.82
Price, Galvanized.....Each	.12	.15	.20	.25	.40	.50	.85	1.35

Size.....Inches	2½	3	3½	4	4½	5	6	
Price.....Each	1.25	2.50	3.25	4.50	5.25	6.00	7.50	
Price, Galvanized.....Each	1.90	3.75	4.75	6.75				

FIG. 61.

STREET ELBOWS

MALLEABLE IRON

Size.....Inches	¼	⅜	½	¾	1	1¼	1½	2	2½
Price.....Each	.10	10	12	.20	.25	.40	.55	.90	1.50
Price, Galvanized.....Each	.12	12	15	28	.35	.55	.80	1.30	

FIG. 62.

TEES

CAST IRON

STRAIGHT

Size....Inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Price....Each	.08	.08	.09	.12	.15	.23	.29	.41	.73	1.10
Price, Galv...Each	.16	.16	.18	.24	.30	.46	.58	.82	1.46	2.20
Size....Inches	3½	4	4½	5	6	7	8	9	10	12
Price....Each	1.50	1.75	2.55	3.00	4.00	6.80	9.75	13.00	19.50	29.00
Price, Galv...Each	3.00	3.50	5.10	6.00	8.00	13.60	19.50	26.00	39.00	58.00

FIG. 63.

REDUCING TEES

CAST IRON

Size.....Inches	½	¾	1	1¼	1½	2	2½	3	3½
Price.....Each	.10	.14	.17	.27	.33	.47	.83	1.25	1.75
Price, Galv....Each	.20	.28	.34	.54	.66	.94	1.66	2.50	3.50
Size.....Inches	4	4½	5	6	7	8	9	10	12
Price.....Each	2.00	2.95	3.50	4.60	7.80	11.25	15.00	22.50	33.50
Price, Galv....Each	4.00	5.90	7.00	9.20	15.60	22.50	30.00	45.00	67.00

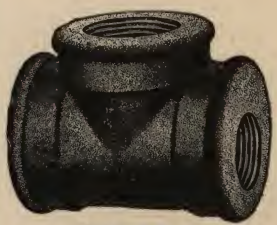


FIG. 64.

ECCENTRIC TEES

CAST IRON

PRICES, ON APPLICATION

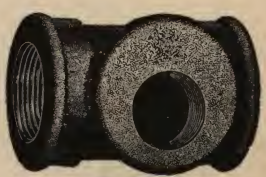


FIG. 65.

The object of these Fittings is to prevent lodging places for water, which always is the case where double reducing Fittings are used.

Some engineers believe that the lodgment of water causes the pipe to eat away by rust.

In ordering these Fittings, always accompany order with a sketch showing permanent position.

Parties desiring R. and L. Tees will please state, when ordering, which hole is to be tapped left hand. Such goods can always be furnished to order.

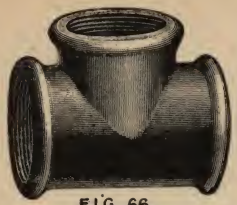


FIG. 66.

TEES

MALLEABLE IRON

STRAIGHT AND REDUCING

Size.....Inches	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2
Price.....Each	.07	.08	.09	.11	.15	.25	.30	.45
Price, Galvanized.....Each	.09	.10	.13	.16	.20	.38	.50	.70

Size.....Inches	2	2 1/2	3	3 1/2	4	4 1/2	5	6
Price.....Each	.60	1.05	1.70	2.50	3.40	4.25	5.00	7.70
Price, Galvanized.....Each	1.00	1.90	3.00	4.25	5.75			

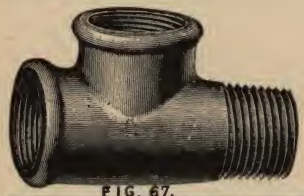


FIG. 67.

SERVICE TEES

MALLEABLE IRON

Size.....Inches	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
Price.....Each	.15	.25	.35	.50	.75	1.15	2.00
Price, Galvanized.....Each	.20	.35	.50	.70	1.10	1.65	

FIG. 68.

FOUR WAY TEES

MALLEABLE IRON

Size.....Inches	3/8	1/2	3/4	1	1 1/4	1 1/2	2
Price.....Each	.12	.14	.20	.35	.50	.80	1.25

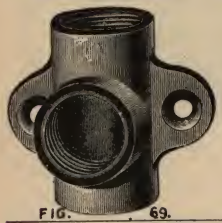


FIG. 69.

DROP TEES

MALLEABLE IRON

Size.....Inches	3/8	1/2	3/4	1
Price.....Each	.10	.14	.22	.30
Price, Galvanized.....Each	.15	.25	.40	.55
Price, with Drop 2 1/2 inches long.....Each	.12			

Parties desiring R. and L. Tees will please state, when ordering, which hole is to be tapped left hand. Such goods can always be furnished to order.

FIG. 70.

SIDE OUTLET ELBOWS

MALLEABLE IRON

Size.....Inches	⅜	½	¾	1	1¼	1½	2
Price .....Each	.08	.10	.18	.30	.45	.60	1.00
Price, Galvanized.....Each	10	15	25	45	65	90	1.50

FIG. 71.

DROP ELBOWS

MALLEABLE IRON

Size .....Inches	¼	⅜	½	¾
Price .....Each	.06	.08	.12	.20
Price, Galvanized.....Each		.12	.20	.35

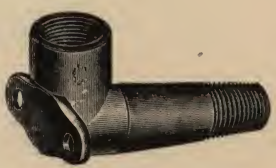


FIG. 72.

DROP ELBOWS

MALLEABLE IRON

WITH DROP 2½ INCHES LONG

Size.....Inches	¼×⅜	⅜×⅜
Price.....Each	.10	.10
Price, Galvanized.....Each	.18	.18

CROSSES

FIG.131

FIG.132

CROSSES CAST IRON STRAIGHT

Size ..... Inches	½	¾	1	1¼	1½	2	2½	3	3½
Price ..... Each	$0.16	$0.22	$0.27	$0.42	$0.53	$0.75	$1.30	$2.00	$2.70
Price, Galvanized ..... Each	.32	.44	.54	.84	1.06	1.50	2.60	4.00	5.40
Size ..... Inches	4	4½	5	6	7	8	9	10	12
Price ..... Each	3.15	4.60	5.50	7.25	12.25	17.50	23.50	35.00	52.50
Price, Galvanized ..... Each	6.30	9.20	11.00	14.50	24.50	35.00	47.00	70.00	105.00

REDUCING CROSSES—CAST IRON

Size ..... Inches	½	¾	1	1¼	1½	2	2½	3	3½
Price ..... Each	$0.18	$0.25	$0.30	$0.46	$0.60	$0.83	$1.45	$2.20	$3.00
Price, Galvanized ..... Each	.36	.50	.60	.92	1.20	1.66	2.90	4.40	6.00
Size ..... Inches	4	4½	5	6	7	8	9	10	12
Price ..... Each	3.50	5.00	6.00	8.00	13.50	19.25	26.00	38.50	58.00
Price, Galvanized ..... Each	7.00	10.20	12.00	16.00	27.00	38.50	52.00	77.00	116.00

CROSSES—MALLEABLE IRON

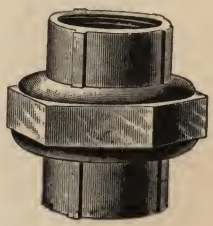
Straight and Reducing

Size ..... Inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5
Price ..... Each	$.08	.10	.12	.20	.30	.40	.60	1.00	1.75	3.00	3.25	5.25	7.50
Price, Galvanized . Each	....	....	.17	.25	.45	.60	.90	1.50	2.75	4.50	....	8.00	....

In ordering crosses be careful to give measurements of all openings. Make a little sketch on your order and there will be no mistake made.

We also make split crosses, not threaded, for one inch pipe. Prices quoted on request.

Fig. 129



UNIONS

MALLEABLE IRON

GASKET EXTRA

Size.....Inches	⅛	¼	⅜	½	¾	1	1¼
Price.....Each	.18	.18	.20	.22	.27	.33	.46
Price, Galvanized.....Each	.27	.27	.30	.33	.40	.50	.70
Size.....Inches	1½	2	2½	3	3½	4	
Price.....Each	.58	.75	1.55	2.10	3.65	4.35	
Price, Galvanized.....Each	.90	1.15	2.35	3.15	5.50	6.50	

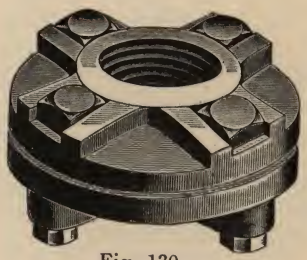


Fig. 130

FLANGE UNIONS

CAST IRON

FACED

GASKET EXTRA

Size .....Inches	¾	1	1¼	1½	2	2½	3
Price .....Each	.46	.52	.64	.78	1.00	1.25	1.50
Price, Galvanized.....Each	.92	1.04	1.28	1.56	2.00	2.50	3.00
Size .....Inches	3½	4	4½	5	6	7	8
Price .....Each	1.80	2.10	2.70	3.15	3.95	5.50	7.00
Price, Galvanized.....Each	3.60	4.20	5.40	6.30	7.90	11.00	14.00

FIG. 73.

RETURN BENDS

CAST IRON

CLOSE PATTERN

Size.....Inches	½	¾	1	1¼	1½	2	2½	3
Price, Right Hand.....Each	.18	.20	.22	.28	.40	.57	1.20	1.70
Price, Right and Left.....Each	.21	.23	.26	.33	.46	.66	1.40	1.95
Price, Left Hand,.....Each	.21	.23	.26	.33	.46	.66	1.40	1.95
Price, Right Hand, Galv....Each	.36	.40	.44	.56	.80	1.14	2.40	3.40
Center to Center.....Inches	1¼	1½	1¾	2¼	2½	3¼	3¾	4¼

RETURN BENDS, PITCHED

CAST IRON

CLOSE PATTERN

SUITABLE FOR COILS AS PER TABLE BELOW

Size.....Inches	1	1	1	1	1	1¼	1¼	1¼
Length of Pipe in Coil.....Feet	3	4	5	6	8	4	5	6
Price, Right Hand.....Each	.26	.26	.26	.26	.26	.33	.33	.33
Price, Right and Left.....Each	.26	.26	.26	.26	.26	.33	.33	.33

All Right and Left Pitched Return Bends are made to order.
One inch Return Bends for coils longer than 8 feet are tapped straight.
Pitched Return Bends have length of coil marked on them.

FIG. 74.

RETURN BENDS

CAST IRON

OPEN PATTERN

Size.....Inches	¾	1	1¼	1½	2	2½	3
Price, Right Haud.....Each	.26	.30	.40	.55	.80	1.35	2.20
Price, Right and Left.....Each	.30	.35	.46	.64	.92	1.55	2.50
Price, Right Hand, Galvanized....Each	.52	.60	.80	1.10	1.60	2.70	4.40
Center to Center.....Inches	1⅞	2⅜	3	3½	4½	5½	6½

FIG. 75.

RETURN BENDS

CAST IRON

WIDE PATTERN RIGHT HAND

Size.....Inches	1	1	1	1	1	1¼	1¼	1½
Price.....Each	.45	.50	.60	.75	1.00	1.00	1.25	1.30
Price, Galvanized.....Each	.80	.90	1.10	1.30	1.60	1.75	2.00	2.30
Center to Center.....Inches	3	4	5	6	8	4	6	4⅞
Size.....Inches	1½	1½	2	2	2	2		4
Price.....Each	1.60	2.00	1.75	2.00	3.00	3.50		7.50
Price, Galvanized.....Each	2.60	3.25	3.00	3.25	4.50	5.00		11.00
Center to Center.....Inches	6	8	4⅞	6	7	8		11

RETURN BENDS

CAST IRON

*SPECIAL PATTERNS

Size.....Inches	1	1	2	2	2½	2½	3
Center to Center.....Inches	4 1/16	4½	2⅞	3	4½	5½	6½

*Made to order only.

FIG. 76.

RETURN BENDS, BACK OUTLET

CAST IRON

Size.....Inches	¾	1	1¼	1½	2	2½	3
Price, Right Hand.....Each	.38	.42	.60	.80	1.15	2.00	3.00
Price, Right and Left...Each	.42	.48	.70	.95	1.30	2.30	3.50
Price, Right Hand, Galv.Each	.76	.84	1.20	1.60	2.30	4.00	6.00
Center to Center.....Inches	1⅞	2¼	2¼	2½	3¼	3¾	4¼

The back outlet of Right and Left Return Bends is always tapped right hand.

FIG. 77.

RETURN BENDS

MALLEABLE IRON.

CLOSE PATTERN — RIGHT HAND

Size ..... Inches	½	¾	1	1¼	1½	2
Price ..... Each	.18	.25	.35	.50	.75	1.00
Price, Galvanized ..... Each	.25	.35	.55	.75	1.15	1.65
Center to Center ..... Inches	1	1¼	1½	1¾	2 5/16	2⅝

RIGHT AND LEFT

Size ..... Inches	½	¾	1	1¼	1½	2
Price, Right and Left ..... Each	.23	.30	.45	.60	.90	1.25
Price, Left Hand ..... Each	.23	.30	.45	.60	.90	1.25

FIG. 78.

RETURN BENDS

MALLEABLE IRON

MEDIUM PATTERN — RIGHT HAND

Size ..... Inches	½	¾	1	1¼	1½	2
Price ..... Each	.18	.25	.35	.50	.75	1.00
Price, Galvanized ..... Each	.25	.35	.55	.75	1.15	1.65
Center to Center ..... Inches	1¼	1½	1⅞	2¼	2½	3

RIGHT AND LEFT

Size ..... Inches	½	¾	1	1¼	1½	2
Price, Right and Left ..... Each	.23	.30	.45	.60	.90	1.25
Price, Left Hand ..... Each	.23	.30	.45	.60	.90	1.25

FIG. 79.

RETURN BENDS

MALLEABLE IRON

OPEN PATTERN

Size.....Inches	½	¾	1	1¼	1½	2	2½	3
Price, Right Hand.....Each	.20	.30	.50	.65	.85	1.25	2.00	3.00
Price, Right Hand, Galv....Each	.28	.45	.70	.90	1.25	2.00	3 50	5.00
Price, Right and Left.....Each	.25	.38	.60	.80	1.05	1.55	2.50	3.75
Price, Left Hand.....Each	.25	.38	.60	.80	1.05	1.55	2.50	3.75
Center to Center.....Inches	1½	2	2½	3	3½	4	4½	5

FIG. 80.

Y BENDS

CAST IRON

Size.....Inches	½	¾	1	1¼	1½	2	2½	3
Price.....Each	.20	.28	.34	.54	.66	.94	1.66	2.50
Price, Galvanized...Each	.40	.56	.68	1.08	1.32	1.88	3.32	5.00
Size.....Inches	3½	4	4½	5	6	7	8	10
Price.....Each	3.50	4.00	5.90	7.00	9.20	15.60	22.50	45.00
Price, Galvanized...Each	7.00	8.00	11.80	14.00	18.40	31.20	45.00	90.00

FIG. 81.

Y BENDS

MALLEABLE IRON

Size.....Inches	1	1¼	1½	2	2½	3	4
Price.....Each	.60	.80	1.00	1.70	2.00	4.00	5.50
Price, Galvanized.....Each	.90	1.25	1.50	2.50	3.00	6.00	8.25

CAST IRON FITTINGS

CAP

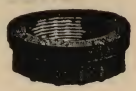


FIG. 82.

LOCKNUT

FIG. 83.

BUSHING

FIG. 84.

PLUG

FIG. 85.

COUNTERSUNK PLUG

FIG. 86.

CAPS

Size.....inches	4	4½	5	6	7	8	9	10	12
Price.....each	.87	1.05	1.20	1.55	2.50	2.85	4.75	5.50	7.00
Galvanized..... "	1.74	2.10	2.40	3.10	5.00	5.70	9.50	11 00	14.00

LOCKNUTS

Size.....inches	2½	3	3½	4	4½	5	6	7	8	9	10	12
Price.....each	.27	.34	.47	.64	.85	.90	1.30	1.70	2.35	2.70	3.00	4.00
Galvanized..... "	.54	.68	.94	1.28	1.70	1.80	2.60	3.40	4.70	5.40	6.00	8.00

BUSHINGS

Size .....inches	⅜	½	¾	1	1¼	1½	2	2½	3	3½
Price.....each	.04	.04	.05	.06	.07	.09	.14	.21	.30	.40
Galvanized.. "	.08	.08	.10	.12	.14	.18	.28	.42	.60	.80

Size .....inches	4	4½	5	6	7	8	9	10	12	....
Price.....each	.50	.75	.93	1.25	1.87	2.75	3.25	3.75	5.00	....
Galvanized.. "	1.00	1.50	1.85	2.50	3.75	5.50	6.50	7.50	10.00	....

PLUGS

Size..inches	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Price...each	.02	.02	.02	.02	.03	.04	.05	.07	.10	.18	.25
Galv.. "	....	.04	.04	.04	.06	.08	.10	.14	.20	.36	.50

Size..inches	3½	4	4½	5	6	7	8	9	10	12	....
Price..each	.38	.42	.65	.88	1.20	1.85	2.75	3.25	3.75	5.00	....
Galv... "	.76	.84	1.30	1.75	2.40	3.70	5.50	6.50	7.50	10.00	....

SPECIAL PLUGS

Size .....inches	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
Countersunk .....each	.04	.06	.08	.09	.11	.15	.30	.40	.92	1.10	2.00	3.50
Left Hand..... "	....	.06	.08	.09	.11	.15	....	....	....	....	....	....
Tapped for air cock "	....	.12	.15	.20	.25	.30	....	....	....	....	....	....

MALLEABLE FITTINGS

REDUCING COUPLING

FIG. 87.

R. H. COUPLING

FIG. 88.

R. & L. COUPLING

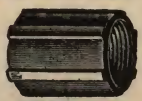


FIG. 89.

CAP

FIG. 90.

REDUCING COUPLINGS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
Plain.....each	.05	.06	.07	.10	.16	.20	.28	.45	.70	1.00	1.50	1.85
Galvanized..... "	.08	.10	.10	.15	.25	.35	.45	.75	1.05	1.65	2.40	3.05

RIGHT HAND COUPLINGS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2
Plain.....each	.03	.05	.07	.10	.14	.20	.25	35
Galvanized..... "	.05	.07	.10	.17	.23	.30	.40	55

RIGHT AND LEFT COUPLINGS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Plain.....each	.04	.06	.08	.12	.16	.25	.36	.52	.70	1.00
Galvanized..... "	.06	.09	.10	.17	.25	.35	.55	.75	1.05	1.50

CAPS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
Plain.....each	.03	.04	.05	.08	.12	.16	.24	.32	.45	.85	1.00	1.20	2.50	3.50
Galvanized..... "	.04	.05	.08	.12	.17	.24	.38	.52	.76	1.30	1.60	2.00	...	...

FLOOR FLANGES.—CAST IRON.

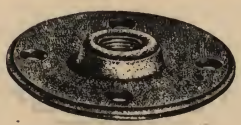


FIG. 190

SIZE OF PIPE..... INCHES	¼	⅜	½	¾	1	1¼	1½	2	2½
Diameter.....2½ inches	.14	.14	.15	.18					
3 "	.14	.14	.15	.18	.20				
3½ "		.17	.17	.18	.20	.23			
4 "		.20	.20	.21	.22	.25	.28		
4½ "			.26	.28	.28	.30	.31		
5 "			.31	.33	.33	.35	.36	.45	
5½ "					.42	.42	.42	.45	
6 "					.52	.52	.52	.55	
6½ "						.62	.62	.65	.75

NOTE.—Galvanized Floor Flanges furnished at double the above list.

BRANCH TEES

FIG. 91. NO. 1. FOR CIRCULATION

FIG. 91. NO. 2. FOR CIRCULATION

FIG. 91. NO. 3. FOR BOX COILS

All openings in Branch Tees for Circulation are tapped right hand.

Branch Tees for Box Coils are always tapped left hand in branches and right hand in back inlet.

The run and back opening of Branch Tees are tapped the same size as branches, unless otherwise ordered.

No. of Branches.	1 IN. BRANCH TEES.			1¼ IN. BRANCH TEES.			1½ IN. BRANCH TEES.			2 IN. BRANCH TEES.		
	2½ IN. CENTER TO CENTER.			3 IN. CENTER TO CENTER.			3½ IN. CENTER TO CENTER.			4½ IN. CENTER TO CENTER.		
	1 in. or 1¼ in. Run.	1½ in. Run.	2 in. Run.	1¼ in. or 1½ Run.	2 in. Run.	2½ in. Run.	1½ in. or 2 in. Run.	2½ in. Run.	3 in. Run.	2 in. Run.	2½ in. or 3 in. Run.	3½ in. Run.
2	.90	1.00	1.15									
3	1.05	1.15	1.35	1.65	1.90	2.40	2.70	3.45	3.80	5.25	5.75	6.25
4	1.15	1.30	1.60	2.00	2.40	2.85	3.35	4.15	4.60	6.40	7.00	7.75
5	1.35	1.45	1.85	2.40	2.90	3.55	4.00	5.00	5.50	7.65	8.50	9.25
6	1.60	1.75	2.10	2.80	3.30	3.95	4.65	5.75	6.25	8.80	9.75	10.75
7	1.90	2.20	2.45	3.20	3.90	4.20	5.25	6.50	7.25	10.60	11.75	13.00
8	2.20	2.45	2.75	3.60	4.50	4.95	5.85	7.00	7.75	11.50	12.75	14.00
9	2.65	2.90	3.40	4.30	5.25	6.15	6.50	8.25	9.00	12.25	13.50	15.00
10		3.30	4.00	4.80	5.85	6.85	7.60	9.25	10.00	13.50	15.00	16.50
11		4.50	4.80	5.00	6.25	7.25	8.00	9.75	10.75			
12		4.75	5.10	5.25	6.50	7.65	8.50	10.50	11.50			
13		5.50	6.00	6.00	7.00	8.25						
14		7.00	7.25	6.75	7.75	9.00						
15		7.50	7.75	7.50	8.50	9.75						
16		8.00	8.25	8.50	9.50	10.75						

1 inch Branch Tees, 1 inch or 1¼ inch run, are 1¾ inches inside diameter.
1 inch Branch Tees, 1½ inch or 2 inch run, are 2¼ inches inside diameter.
1¼ inch Branch Tees are all 2½ inches inside diameter.
1½ inch Branch Tees are all 2¾ inches inside diameter.
2 inch Branch Tees are all 3½ inches inside diameter.
Always order Branch Tees by size and number.

HOOK PLATES

FIG. 92.

FIG. 93.

No. of Hooks	1	2	3	4	5	6
For 1 inch Pipe, 2½ inches between Centers..Price	.09	.18	.23	.26	.32	.38
For 1¼ inch Pipe, 3 inches between Centers..Price	.10	.21	.27	.32	.41	.52
For 1½ inch Pipe, 3½ inches between Centers..Price	.15	.28	.43	.58	.72	.88
For 2 inch Pipe, 4½ inches between Centers..Price	.22	.43	.65	.90	1.15	1.35

HOOK PLATES

FIG. 94.

EXPANSION

No. of Hooks	1	2	3	4	5	6
For 1 inch Pipe, 2½ inches between Centers..Price	.15	.25	.35	.50	.60	.70
For 1¼ inch Pipe, 3 inches between Centers..Price	.17	.27	.40	.60	.70	.80
For 1½ inch Pipe, 3½ inches between Centers..Price	.25	.40	.60	.75	.90	1.00
For 2 inch Pipe, 4½ inches between Centers..Price		.60	.85	1.00	1.35	1.55

FIG. 95.

BEAM HOOKS

LONG SHANK

Size.....Inches	½	¾	1	1¼	1½	2	2½	3
Price.....Each	.13	.15	.18	.22	.24	.35	.65	.90

FIG. 96.

LAUNDRY COIL STANDS

FOR 1 INCH PIPE

WITH MOVABLE HOOK PLATES

Price, for Four Pipes high	Each	2.00
Price, for Six Pipes high	Each	2.75
Price, for Eight Pipes high	Each	3.50
Price, for Ten Pipes high	Each	4.25
Extra Hooks, complete for 1 inch	Net, Each	.06
Extra Hooks, complete for 1¼ inch	Net, Each	.08
Extra Hooks, complete for 1½ inch	Net, Each	.10
Extra Hooks, complete for 2 inch	Net, Each	.15

RAILING FITTINGS

MALLEABLE IRON

FOR FENCES, ENCLOSING ENGINES AND MACHINERY, EXHIBITION SPACES, ETC.

FIG. 102. No. 1

FIG. 102. No. 2

FIG. 102. No. 3

FIG. 102. No. 4

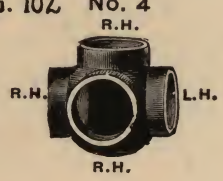


FIG. 102. No. 5

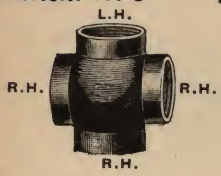


FIG. 102. No. 6

FIG. 102. No. 7

FIG. 102. No. 8

INSTRUCTIONS FOR ORDERING

In ordering these Fittings, describe kind wanted by number and size.

Fittings tapped as above will be furnished, unless otherwise specified.

Fittings tapped otherwise than those shown on the above cuts will be charged at 15 per cent additional, net.

Pipe Size.....Inches	1	1¼	1½	2
Price, No. 1, Elbow.....Each	.20	.35	.45	.72
Price, No. 2, Elbow, Side Outlet.....Each	.25	.40	.50	.80
Price, No. 3, Tee.....Each	.25	.40	.50	.75
Price, No. 4, Tee, Side Outlet.....Each	.35	.45	.55	.90
Price, No. 5, Cross.....Each	.35	.45	.58	1.00
Price, No. 6, Cross, Side Outlet.....Each	.40	.50	.65	1.35
Price, No. 7, Floor Flange.....Each	.20	.40	.50	.90
Price, No. 8, Acorn Ornament.....Each	.20	.25	.35	.90

FLOOR AND CEILING PLATES

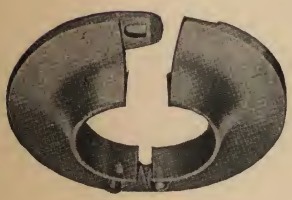


Fig. 98

PRICE LIST

Size,	½"	¾	1	1¼	1½	2
Black,	$0.14	.14	.18	.20	.24	.28
Nickeled,	.25	.25	.28	.32	.35	.38
Pol. Brass,	.37	.43	.50	.55	.60	.70

STANDARD

GLOBE VALVES

BRASS

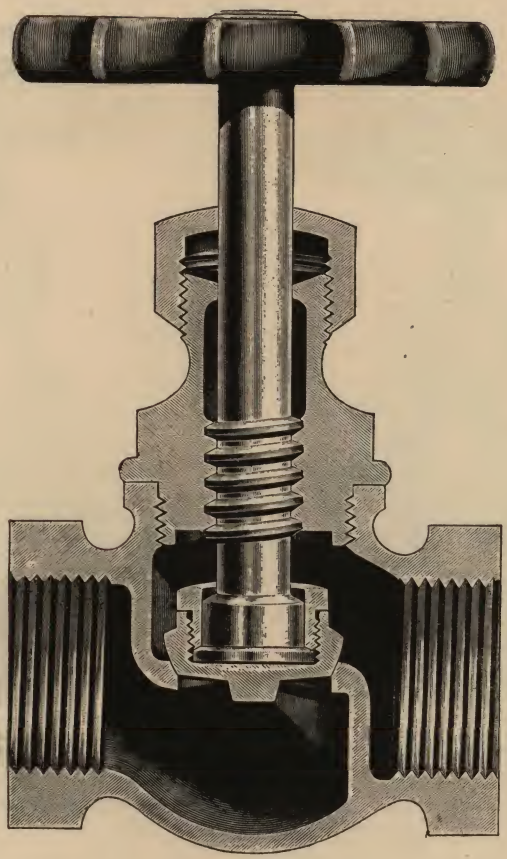


FIG. 103.

SECTION CUT.

On the following pages we have shown as complete a line of valves as space would permit and believe the range of styles and sizes will meet all the general requirements of the trade. In ordering valves be sure to specify for what purpose they are to be used and if for steam the number of pounds pressure to be carried.

STANDARD

GLOBE AND ANGLE VALVES

BRASS

GLOBE

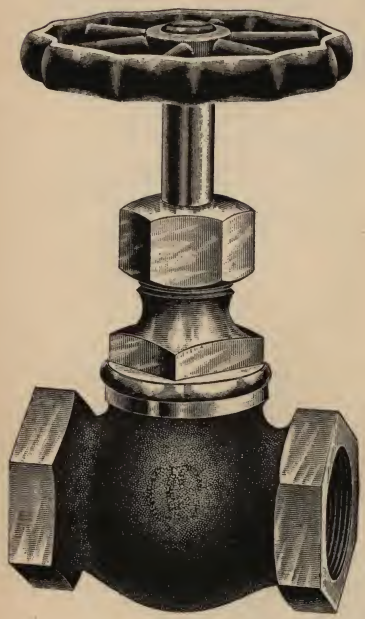


FIG. 104.

ANGLE

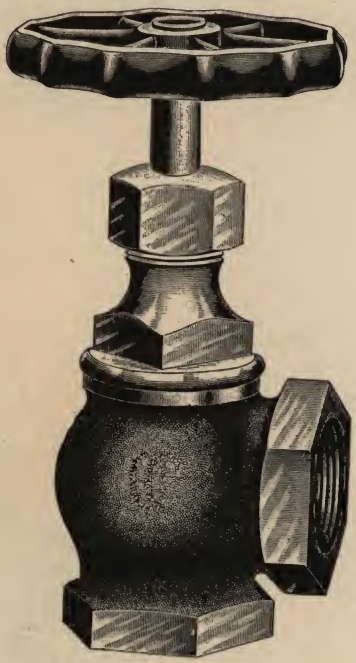


FIG. 105.

Size .....Inches	⅛	¼	⅜	½	¾	1	1¼
Price .....Each	.72	.72	.77	1.00	1.26	1.80	2.52
Size .....Inches	1½	2	2½	3	3½	4	
Price .....Each	3.50	5.30	10.00	14.40	26.50	36.00	

JENKINS DISC
GLOBE AND ANGLE VALVES

BRASS

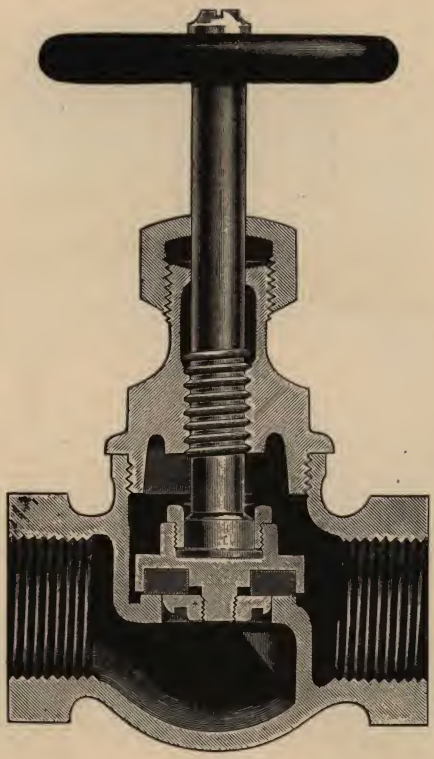


FIG. 106. SCREWED

Size .....Inches	¼	⅜	½	¾	1	1¼	1½	2	2½	3
Price .....Each	1.10	1.25	1.60	2.20	2.80	4.00	5.50	8.75	15.75	22.00

FIG. 106. FLANGED

Size ... .Inches	¾	1	1¼	1½	2	2½	3
Price..... ....Each	5.00	6.00	9.00	11.00	16.50	25.00	34.00

When Valves are wanted for water they will be furnished with Soft Discs. Flanged Valves made to order only at a special discount.

STANDARD
HORIZONTAL CHECK VALVES
BRASS

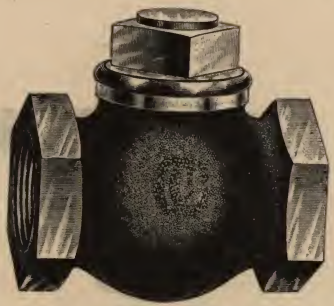


FIG. 107.

Size .....Inches	⅛	¼	⅜	½	¾	1	1¼
Screwed .....Each	.65	.65	.70	.90	1.15	1.60	2.25
Flanged .....Each					4.90	6.50	8.25
Size .....Inches	1½	2	2½	3	3½	4	
Screwed .....Each	3.15	4.75	9.00	13.00	24.00	32.50	
Flanged .....Each	10.15	15.50	22.00	33.50	47.50	66.50	

STANDARD
CHECK VALVES
VERTICAL
BRASS
ANGLE

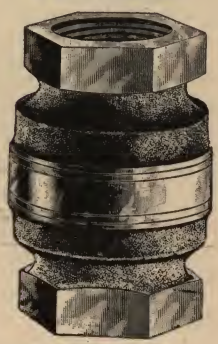


FIG. 108.

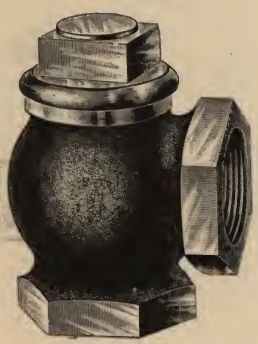


FIG. 109.

Size.....Inches	⅛	¼	⅜	½	¾	1	1¼	1½	2
Price, Vertical.....Each		.72	.77	1.00	1.26	1.80	2.52	3.50	5.30
Price, Angle.....Each	.72	.72	.77	1.00	1.26	1.80	2.52	3.50	5.30

STANDARD
SWING CHECK VALVES
BRASS

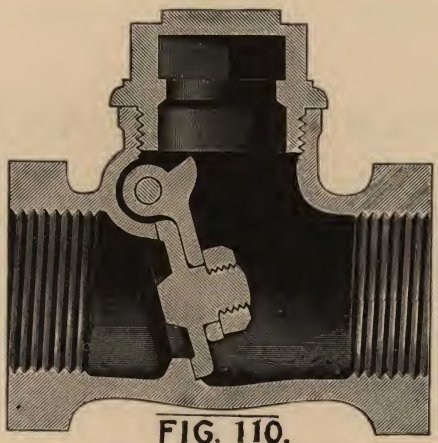


FIG. 110.

Size.....Inches	⅜	½	¾	1	1¼	1½	2	2½	3
Price.....Each	2.15	2.25	2.75	3.50	4.25	5.50	7.50	15.00	22.00

UNION ELBOWS
BRASS
FOR HOT WATER RADIATORS

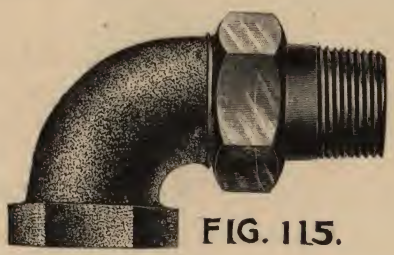


FIG. 115.

Size .....Inches	¾	1	1¼	1½	2
Rough body plated all over.....Each	2.00	2.50	3.20	4.00	7.00

RADIATOR VALVES

FOR

STEAM AND HOT WATER

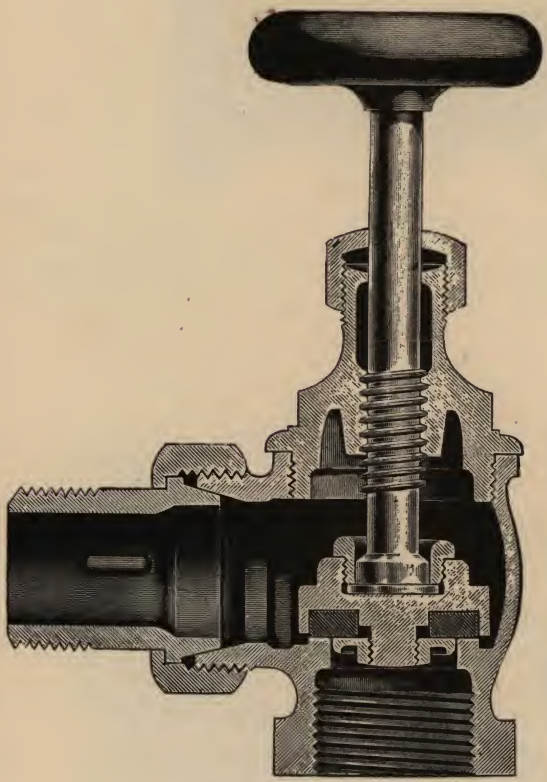


FIG. 111.

JENKINS DISC ANGLE VALVES

On the following pages we illustrate a full variety of Radiator Valves, which we believe are sufficient to meet all requirements of the trade.

JENKINS' DISC

RADIATOR VALVES

WITH UNION

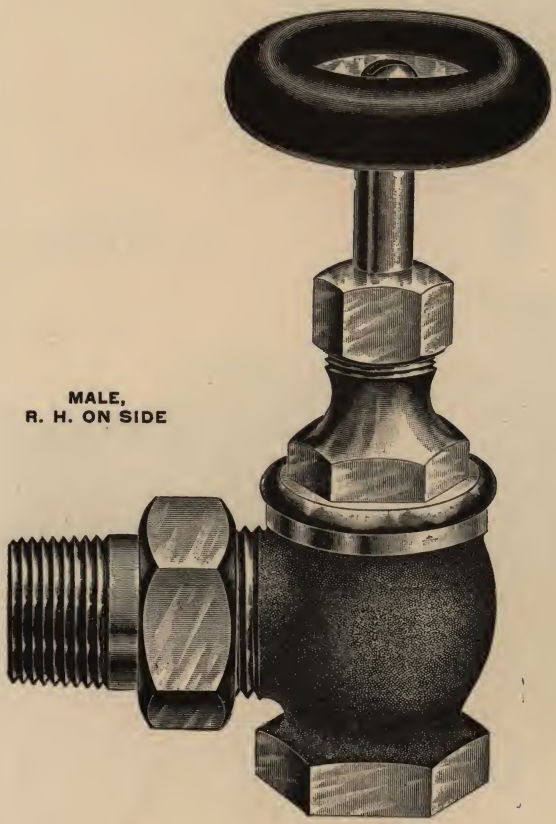


FIG. 112.

WOOD WHEEL

Size .....Inches	¾	1	1¼	1½	2
Rough body plated all over.....Each	3.80	4.75	6.40	8.10	13.10

QUICK OPENING
HOT WATER RADIATOR VALVES
WITH UNION AND BY-PASS

MALE,
R. H. ON SIDE

FEMALE,
R. H. ON BOTTOM

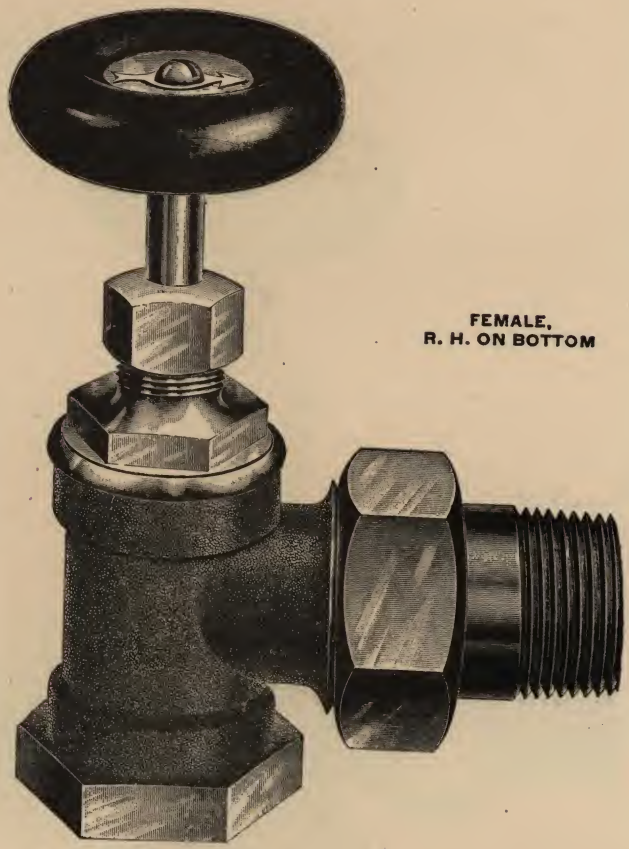


FIG. 114.

WOOD WHEEL

Size ..... Inches	¾	1	1¼	1½	2
Rough body plated all over..... Each	2.85	3.65	5.05	7.10	10.85

STANDARD

GLOBE VALVES

IRON BODY BRASS MOUNTED

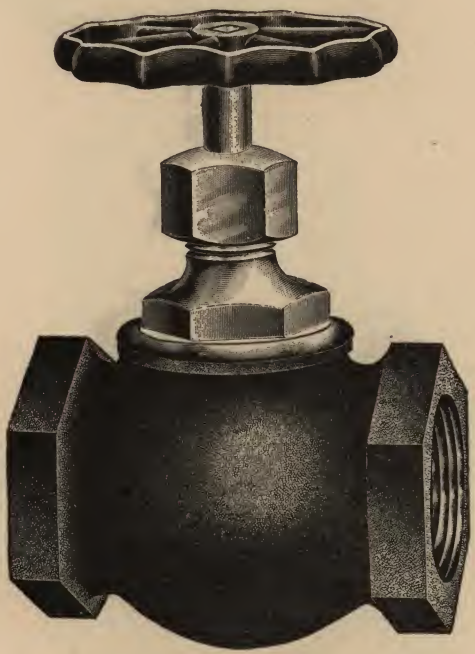


FIG. 116. SCREWED

Size ..... Inches	2	2½	3
Price ..... Each	5.40	7.35	9.80

FIG. 116. FLANGED

Size ..... Inches	2	2½	3
Price ..... Each	7.00	9.00	12.50

STANDARD

ANGLE VALVES

IRON BODY

BRASS MOUNTED

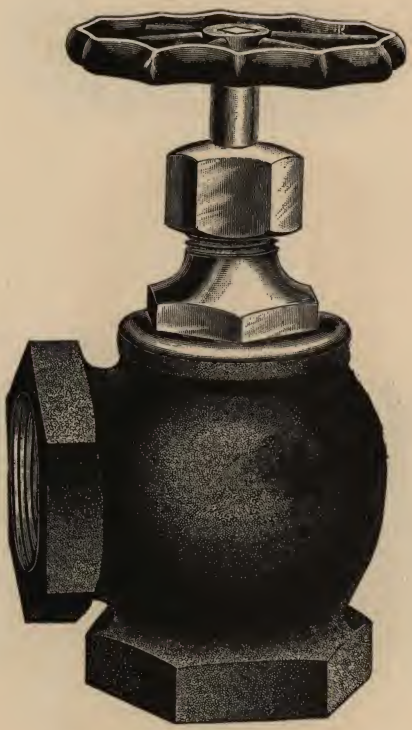


FIG. 117. SCREWED

Size ..... Inches	2	2½	3
Price ..... Each	5.40	7.35	9.80

FIG. 117. FLANGED

Size ..... Inches	2	2½	3
Price ..... Each	7.00	9.00	12.50

STANDARD

GLOBE AND ANGLE VALVES

IRON BODY, WITH YOKE BRASS TRIMMINGS

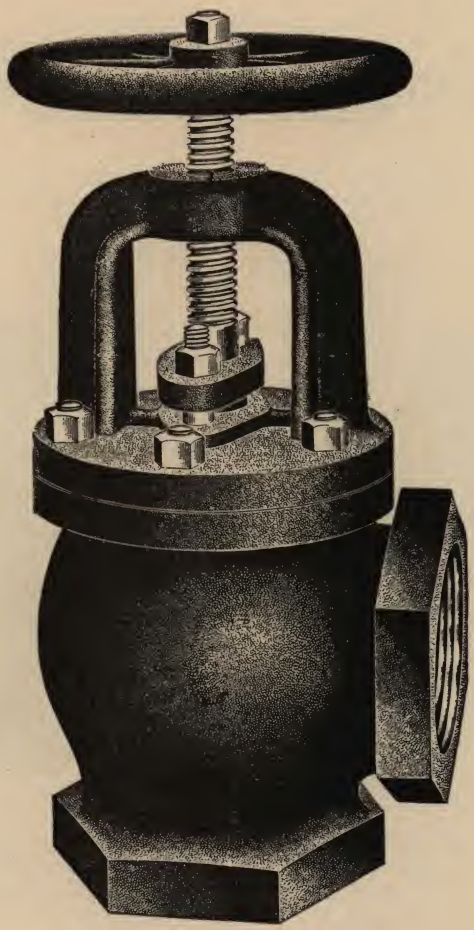


FIG. 119. SCREWED

Size .....Inches	3	3½	4	4½	5	6
Screwed .....Each	12.50	15.25	19.00	24.00	27.00	37.50
Flanged .....Each	15.00	18.50	22.50	27.50	31.00	42.00

JENKINS DISC
GLOBE AND ANGLE VALVES

IRON BODY, WITH YOKE — BRASS TRIMMINGS

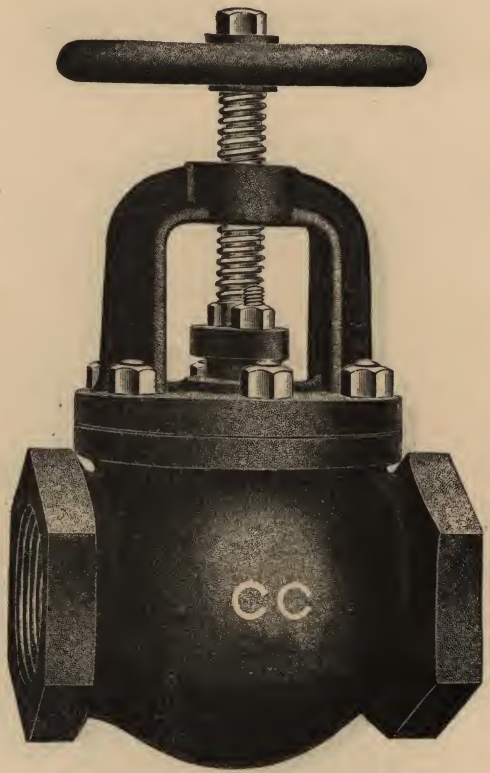


FIG. 193 SCREWED

Size ..... Inches	3	3½	4	4½	5	6
Screwed ..... Each	16.75	19.50	24.00	32.00	40.00	48.00
Flanged ..... Each	18.50	21.50	26.00	34.00	42.00	50.00

STANDARD

SWING CHECK VALVES

IRON BODY **BRASS SEAT**

WITH BRASS OR LEATHER DISCS

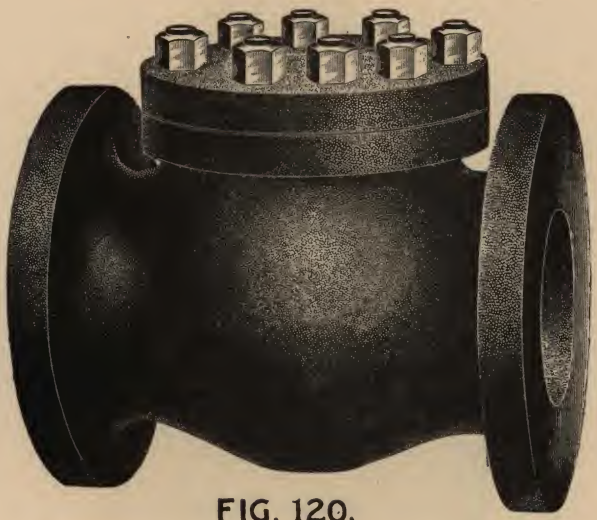


FIG. 120.

Size .....Inches	2½	3	3½	4	5	6	7
No. 372, Screwed Ends...Each	15.00	18.00	24.00	27.00	38.00	48.00	62.00
No. 373, Flanged Ends...Each	17.00	21.00	27.00	30.00	42.00	52.00	67.00
No. 374, Hub Ends.....Each		24.00		35.00	48.00	60.00	

STRAIGHT-WAY VALVES

BRASS

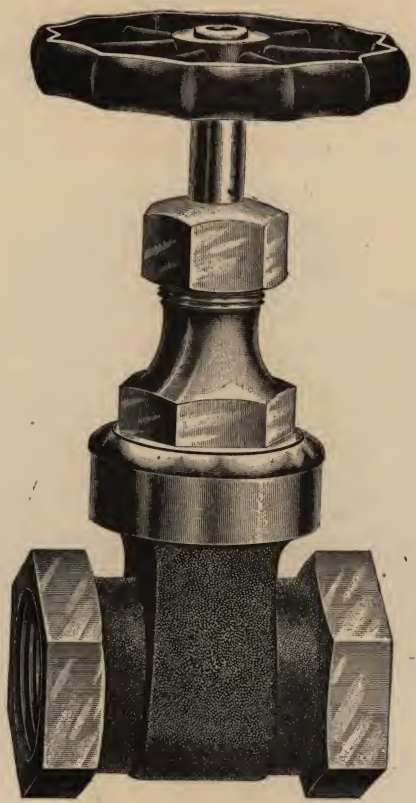


FIG. 121. SCREWED

Size ..... Inches	¼	⅜	½	¾	1	1¼	1½
Price ..... Each	1.25	1.25	1.30	1.75	2.50	3.50	5.00
Size ..... Inches	2	2½	3				
Price ..... Each	7.50	14.00	20.00				

STRAIGHT-WAY VALVES

IRON BODY WEDGE GATE BRASS TRIMMINGS

OPEN TO THE LEFT NON-RISING STEM

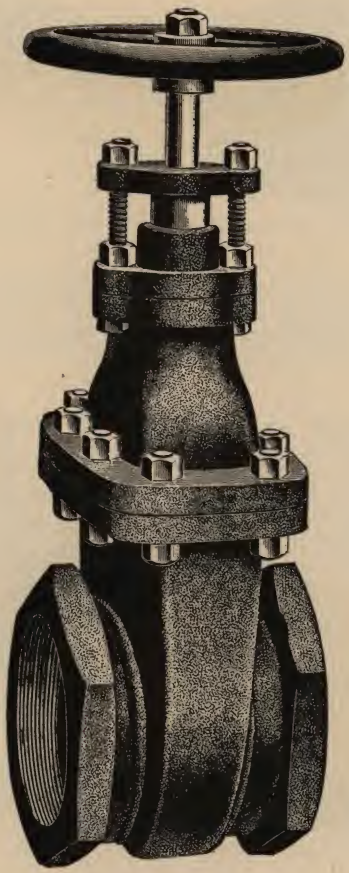


FIG. 122. SCREWED

Size....Inches	2	2½	3	3½	4	4½	5	6	7
Price....Each	10.00	11.50	14.00	17.00	19.00	24.00	27.50	32.50	45.00

Furnished screwed or with hub ends same price.

Flanged valves at higher price.

Fig. 153

Davis-Eclipse

"ECLIPSE" REDUCING VALVE.

This is our OLD RELIABLE No. 110 ECLIPSE REDUCING VALVE, for steam only.

This is the oldest regulating Valve on the market and while a few changes have been made in its construction, it is practically the same as originally designed.

It is very simple, having no complicated parts, springs or packing.

For controlling steam pressure, where flow of steam is nearly even, as on tanks, steam heating, etc., it has no superior and will work to perfection with pressure up to 125 pounds reducing to 8 to 60 pounds. For other duties, see our Figs. Nos. 81, 71, 211, 91, 95, and 181 Valves.

Fig. 153

Give boiler pressure and pressure to be reduced to

PRICE LIST.

1 in.....	$23.00	4½ in.....	$ 70.00
1¼ "	24.00	5 "	75.00
1½ "	25.00	6 "	100.00
2 "	30.00	7 "	125.00
2½ "	35.00	8 "	185.00
3 "	42.50	10 "	275.00
3½ "	52.50	12 "	350.00
4 "	60.00		

For pressure above 125 pounds, special net prices on application.

RUBBER HOSE AND HOSE GOODS

Reel—500 Feet

It is a Moulded, Indestructible Hose for the Lawn, Greenhouse, Stable and Garage.

Being of continuous length, you can get any length wanted up to 500 feet in *one Piece*—thereby avoiding leaky couplings whenever long lengths are necessary.

The unique feature of this hose is its construction, which is radically different from the well known old style, or commonly termed "wrapped duck construction."

Revero possesses many features superior to the old style, and we can assure the most skeptical that its many advantages have been by this time fully demonstrated and appreciated, to the extent that where extreme use and abuse exist it meets fully everything demanded of it.

¾ inch. Per foot $0.17

THE EVANSTON HOSE COUPLING

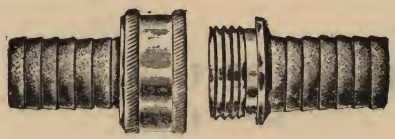


Fig. No. 649.

Life size, ¾ inch.

Made in ½ inch, ⅝ inch and ¾ inch only.

The Evanston is a good coupling for high grade hose.

List Prices

½ inch. Per dozen .....
⅝ inch. Per dozen .....
¾ inch. Per dozen .....

"CHAMPION" SPRAY NOZZLE

Fig. No. 650.
(Patent Applied For.)

A new nozzle brought out in 1913, which has advantages over every other spray nozzle in that in forming the spray, there is no back pressure to retard the flow of water and there is as much water discharged with the spray as with the full stream.

The Champion Nozzle has no shut-off, but this may be an advantage as it does not strain the hose, besides which the shut-off is used very little in actual practice.

Moreover there is nothing about the Champion Spray Pipe to get out of order, it will last indefinitely, gives a copious spray well distributed, a generous full stream and it is bound to be a popular seller. Made in the ¾ inch size only.

List price, per dozen, ¾ inch brass $4.50
List price, per dozen, ¾ inch N. P. 5.00

Packed 1 dozen in a pasteboard box; 12 dozen in a wooden case.

Shipping weight, per gross, 40 pounds.

MONINGER IMPROVED ACME HOSE COUPLER

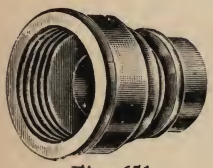


Fig. 651

No. 3. For New and Old Hose

Goes on faucet, where it can be left permanetly; also on end of ground pipe (Nos. 1 or 4 are used with it), and on old style coupling, taking the place of No. 2.

List price, ¾ inch, per dozen $1.80

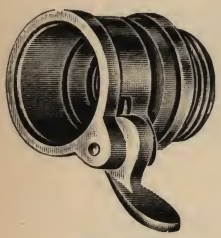


Fig. 652

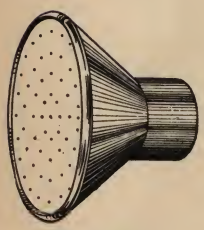
No. 4. For Old Hose

Used in connection with old style couplings already fitted. Also on nozzels (used with Nos. 2 or 3).

List price, ¾ inch, per dozen.....$3.60

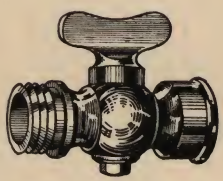
NOTE—Acme Couplings are made both for ½ and ¾ inch hose. The only difference is in Nos. 1 and 2. Nos. 3 and 4 are the same, whether used on ½ or ¾ inch hose.

MONINGER SPRINKLERS AND ¾-INCH SHUT-OFFS



Sprinkler.
Fig. No. 653

Solid brass and copper. You can't afford to be without these items. Latest and best made.



Hose Shut-off.
Fig. No. 654
For end of hose.

LIST PRICES.

Sprinkler, ¾ inch only, 3 inch diameter. Per dozen.....$7.40
Sprinkler, ¾ inch only, 4 inch diameter. Per dozen..... 9.00
Hose Shut-off, ¾ inch only. Per dozen..... 7.00

This hose shut-off and sprinkler saves time, saves water and saves trouble.

Fig. 655

LIST PRICES.

List price, per dozen, ¾ inch brass $4.20
List price, per dozen, 1 inch brass 8.00

STANDARD

GARDEN HOSE VALVES

BRASS

WITH LEATHER DISC

FIG. 123.

FIG. 124

Size.....Inches	½	¾	1	1¼	1½	2	2½
Price, No. 123.....Each	$1.65	$1.65	$2.20	$3.40	$4.75	$7.00	$15.00
Price, No. 124.....Each	1.65	1.65	2.20	3.40	4.75	7.00	15.00

BIBB COCKS

SCREWED FOR IRON PIPE, WITH SHOULDER

LEVER HANDLE

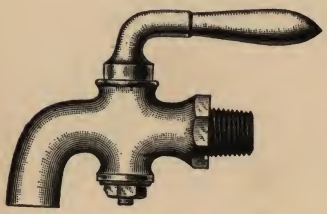


Fig. 155

Fig. 156

Size.....Inches	⅜	½	⅝	¾	1	1¼	½	2
Rough .....dozen	$17.40	$18.60	$25.80	$30.60	$42.00	$70.20	$105.00	$186.00
Finished .....dozen	21.60	22.80	30.60	36.60	51.00	82.20	123.00	210.00
Rough, for hose...dozen	.....	21.00	28.30	33.00	48.00	79.20	117.00	204.00
Finished, for hose.dozen	.....	25.20	33.00	39.00	57.00	91.20	135.00	228.00

COMPRESSION BIBBS

SCREWED FOR IRON PIPE, WITH SHOULDER

Fig. 157

Size .....Inches	⅜	½	⅝	¾	1
Rough .....Per dozen	$13.20	$13.80	$19.20	$25.20	$45.00
Finished .....Per dozen	13.80	14.40	20.40	26.40	48.00
Rough, for hose.....Per dozen		16.20	21.60	27.60	51.00
Finished, for hose.....Per dozen		16.80	22.80	28.80	54.00

COMPRESSION

RADIATOR AIR VALVES

BRASS

Fig. 158

Fig. 159

Fig. 160

Fig. 161

Fig. 162

Chased Iron Pipe		Plated	
Size	Inches	⅛	¼
Fig. 158 all brass	Each	.35	.40
Fig. 159 wood wheel	Each	.45	.55
Fig. 160 wood wheel with nose	Each	.70	.75
Fig. 161 lock and shield	Each	.35	.40
Fig. 162 lock and shield	Each	.57	

Keys for Fig. 161 and Fig. 162 extra. Plated, each 18 cents.

Fig. 163

Fig. 164

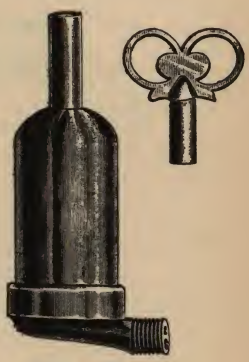


Fig. 165

Number	ILLINOIS	6	LOCK AND SHIELD 6.
Price, Plated Each	1.25	1.25	1.50

No. 6 is a double passage circulating Duplex Float Valve, which shuts off steam by expansion and water by floatation.

No. 6, with Lock Shield and Key, specially designed for public institutions.

BIBB AIR COCKS

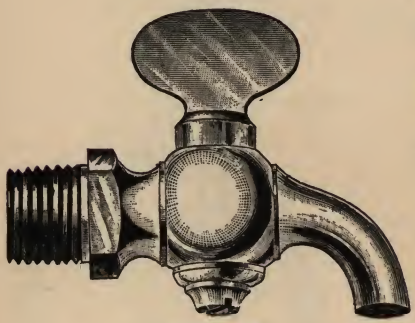


FIG. 166

Size, iron pipe thread .....Inches	⅛	¼	⅜
Tee handle, Fig. 166 .....each	.70	.80	.90
Lever handle, Fig. 166 .....each	.85	.95	1.05

AIR COCKS

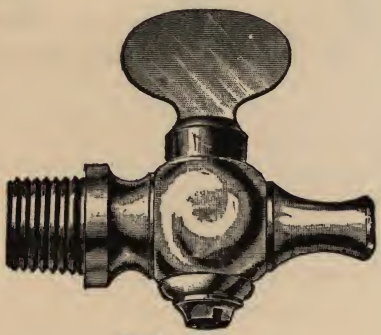


FIG. 167

Size, iron pipe thread .....Inches	⅛	¼	⅜
Tee handle, Fig. 167 .....each	.40	.45	.50
Lever handle Fig. 167 .....each	.55	.60	.65

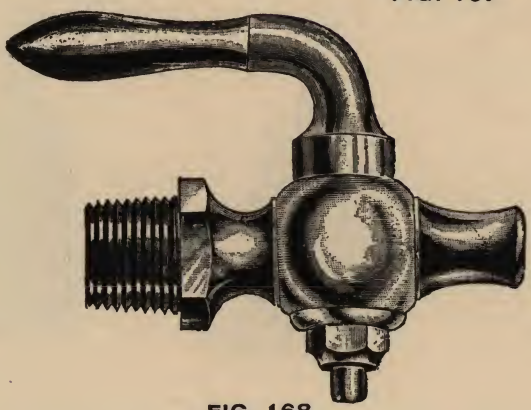


FIG. 168

Size, iron pipe thread .....Inches	¼	⅜	½
Tee handle, Fig. 168	.80	.85	.90
Lever handle, Fig. 168	.95	1.00	1.05

SCREW PLATES

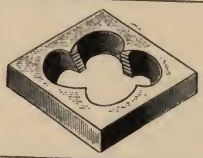
MALLEABLE IRON

WITH SOLID DIES

VIEW OF No. 1 AND No. 1¾ STOCK AND DIE

PRICE LIST AND DIMENSIONS

	No. 1	No. 1¾
Plate		
Dies Furnished with each Plate	¼ to 1	1 to 1½
Dimensions of Dies	2½ × ¾	3 × ¾
Screw Plate, with Dies Complete ..... Each	15.00	13.50
Screw Plate, without Dies ..... Each	5.00	6.00



	No. 1	No. 1¾
Plate		
Extra Dies, Right or Left Hand ..... Each	2.00	2.50
Extra Bushings ..... Each	.35	.45

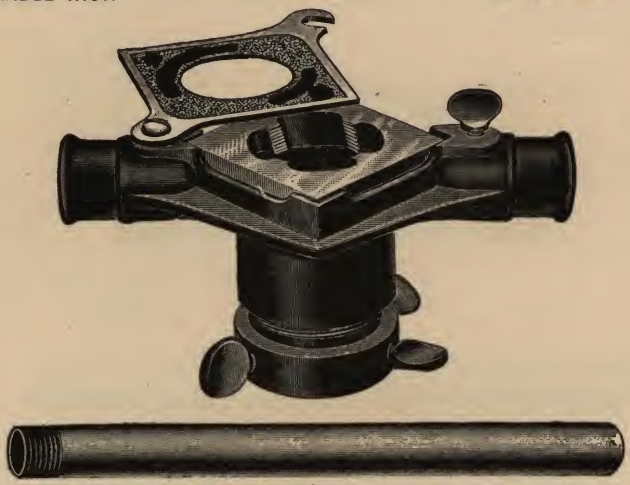
One-eighth Dies and Bushings for No. 1 Plate furnished at same price as larger sizes. Three-eighths, ½ and ¾ Dies and Bushings for No. 1¾ Plate furnished at same price as larger sizes.

EXTRA PARTS

	No. 1	No. 1¾
Plate		
Caps ..... Net, Each	.20	.30
Thumb Screws for Cap or Bushing ..... Net, Each	.10	.10
Machine Screws for Cap ..... Net, Each	.05	.05
Handles ..... Net, Per Pair	.70	.80
Die Frames ..... Net, Each		.12

SCREW PLATES

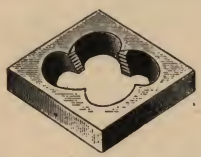
MALLEABLE IRON WITH SOLID DIES



VIEW OF No.2 STOCK WITH LEADER SCREW

PRICE LIST AND DIMENSIONS

Plate		No.2
Dies Furnished with Each Plate		1¼ to 2
Dimensions of Dies		4×⅞
Screw Plate, with Dies Complete	Each	20.00
Screw Plate, without Dies	Each	9.50



Extra Dies, Right or Left Hand	Each	3.50
Extra Bushings	Each	.60

One-half, ¾ and 1 inch Dies and Bushings for No.2 Plate furnished at same price as larger sizes.

EXTRA PARTS

Caps	Net, Each	.30
Thumb Screws for Cap	Net Each	.10
Machine Screws for Cap	Net, Each	.05
Leader Screws	Net, Each	.75
Thumb Screws for Leader	Net, Each	.10
Handles	Net, Per Pair	1.00
Die Frames	Net, Each	.20

TOLEDO PIPE THREADING DEVICES

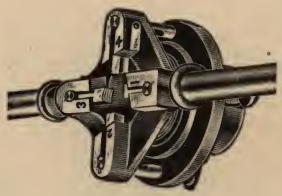


Fig. 179

No. 1—Capacity 1″ to 2″ inclusive.
List Price, $24.00.

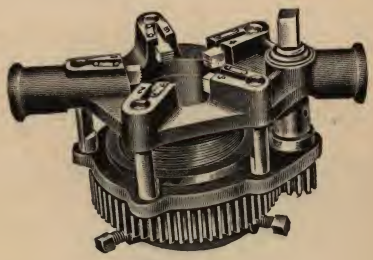


Fig. 180

No. 2—Capacity 2½″ to 4″ inclusive
List Price, $100.00.

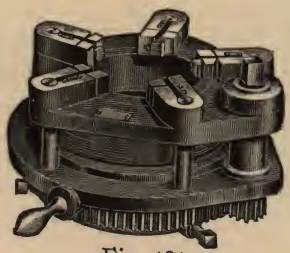


Fig. 181

No. 3—Capacity 4½ inches to 8 inches inclusive.
List Price, $300.00

One man can thread any size pipe within the capacity of these tools. Made in seven sizes, to thread any size pipe up to and including 12 in.

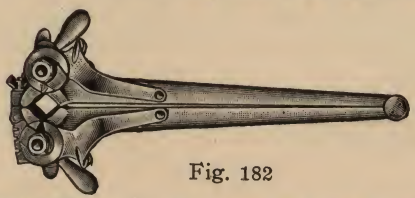


Fig. 182

"Toledo" Pipe Cutter—Capacity ⅛ inch to 2 inch Pipe.
Cuts Pipe off without making a burr
List Price, $16.00.

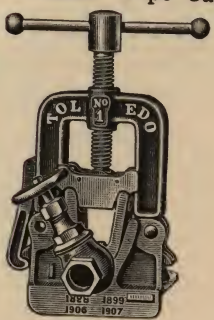


Fig. 183

"TOLEDO" Vises, made in two sizes:

No. 1—Capacity ⅛″ to 2½″ pipe—List price.....$10.00
No. 2—Capacity ⅛″ to 4½″ pipe—List price..... 20.00

Is more than a pipe-vise—will hold anything that will go in the jaws.

Fig. 183

ARMSTRONG'S
ADJUSTABLE PIPE STOCKS AND DIES

FIG. 232

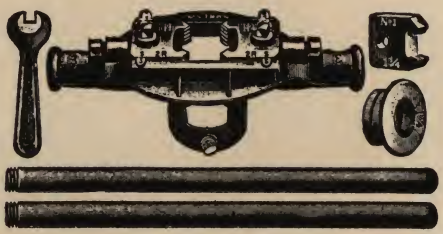


FIG. 233

No.	Number of Dies	Threads Pipe Inches	Price Each							
			Complete	Stock Only	Extra Dies Right or Left Hand	Extra Bushings	Extra Collar Screws	Extra Adjusting Screws	Extra Thumb Screws	Extra Wrenches
1	4 Single End....	⅛ to ½	9.00	3.25	1.25	.20	.12	.10	.10	.25
2	5 " "	¼ " 1	12.00	4.00	1.50	.25	.12	.10	.10	.25
2½	4 Double "	½ " 1¼	12.00	4.50	3.25	.40	.15	.15	.10	.25
3	3 Single "	1¼ " 2	20.00	7.00	4.00	.50	.15	.15	.15	.50
6	2 Double "	2½ " 3	40.00	25.00	15.00	1.00	.25	.20	.....	.50
7	8 " "	2½ " 4	60.00	30.00	16.00	1.50	.25	.20	.....	.75

Prices for Dies are per set of two pieces, except No. 7, which is per set of four pieces. Nos. 6 and 7 have four arms.

RATCHET ATTACHMENTS

FOR STOCKS Nos. 2, 2½, 3, 6, 7

FIG 334

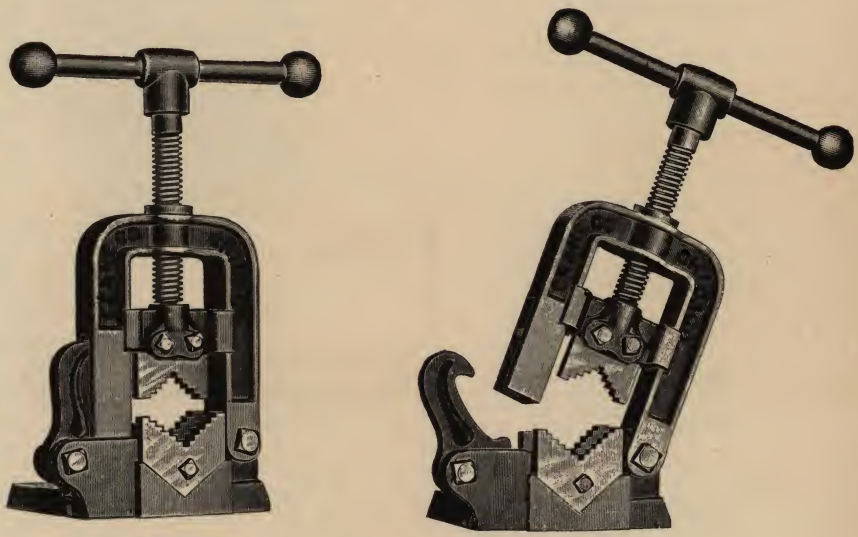
MODEL B FOR STOCKS Nos. 2, 2½, 3

FIG. 235

RATCHET ATTACHMENTS

For Stock Number	2	2½	3	6	7
Price.....each	2.50	3.00	3.50	5.00	5.00

MALLEABLE IRON PIPE WISES



SHUT OPEN

Fig. 178

The Malleable Iron Pipe Vise is preferable to the Cast Iron Vise in every respect, being much lighter, more durable and cheaper. Has interchangeable cut steel jaws, and is constructed to do the heaviest work, great care having been taken in manufacturing the various parts, and the strength put where it is most required.

PRICE LIST

Number	1	2
Holds Pipe from	⅛ to 2 Inches	⅛ to 3 Inches
Weight.....Pounds	16	30
Price.....Each	10.00	14.00
Extra Jaws, per set of three.....Net	.60	.90
Extra Yoke.....Net	.60	.85
Extra Screw.....Net	.25	.40
Extra Slide.....Net	.10	.15
Extra Handle.....Net	.15	.20
Extra Bottom Piece.....Net	.60	.75
Extra Hook.....Net	.10	.15

"VULCAN" CHAIN PIPE VISE

Lying dormant, much too long, the valuable principles of the well-known "Vulcan" Chain Pipe Wrench have been most successfully applied to a vise.

It's "just a handful." You'll never again take the old kind" for service away from the workshop. Carry it in your hand or tool bag. Requires almost no space on bench or post. A little ten-pound giant. Size, folded, 6x8x8 inches.

Fig. 236

No.	For Pipe, Sizes	Price, each	Prices, extra parts						
			Base	Jaws	Chain	Handle	Screw	Nut	Washer
2	⅛ to 4	$5.00	$1.00	$2.25 pr.	$1.25	$ .50	$ .20	$ .60	$ .20

THE VULCAN "BIJAW" PIPE WRENCH

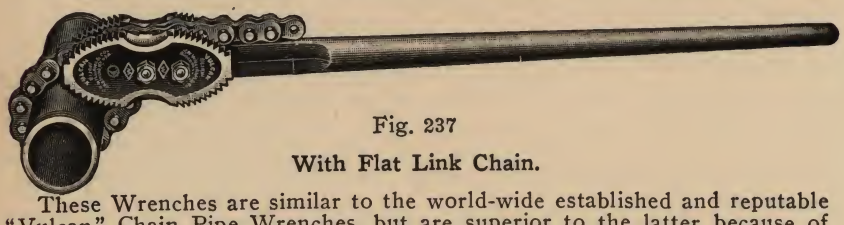


Fig. 237

With Flat Link Chain.

These Wrenches are similar to the world-wide established and reputable "Vulcan" Chain Pipe Wrenches, but are superior to the latter because of their **reversible jaws.** These may be quickly and easily changed end for end as the teeth first in use wear, thus doubling the life of the jaws—a unique feature, the value of which is readily apparent.

The Reversible Jaws, being firmly fastened to the handle by two studs or bolts as shown by the cut, cannot spread in use.

All parts are interchangeable; repairs can always be had.

When ordering, state which chain is desired. Flat Link Chain will be sent unless otherwise specified.

Number	30	31	32	33	33½	34	35
Capacity Size Pipe	⅛ to ¾"	⅛ to 1¼"	¼ to 2½"	¾ to 4"	1 to 6"	1¼ to 8"	2 to 12"
Price, each with **Flat Link Chain**	$2.50	$3.50	$5.00	$7.00	$9.00	$11.00	$18.00
Price, each with **Cable Chain**	$2.25	$3.25	$4.50	$6.25	$7.75	$9.50	$16.00
Extreme Length	13⅜"	20"	27"	37"	44½"	50½"	64½"
Weight	1⅜ lbs.	5⅜ lbs.	10 lbs.	16 lbs.	24 lbt.	31 lbs.	50 lbs.
Extra Jaws, Pair	$1.00	$1.75	$2.75	$4.00	$4.75	$5.50	$7.50
Extra Flat Link Chain, each	$0.75	$1.00	$1.50	$2.50	$3.25	$4.00	$6.00
Length	9½"	13¼"	17½"	22½"	31"	39"	54½"
Breaking Strain ..... Pounds	3,600	6,700	9,800	12,500	14,300	15,700	21,800
Extra Cable Chain, each	$0.50	$0.75	$1.00	$1.75	$2.00	$2.50	$4.00
Length	9¾"	14½"	18"	27"	33⅛"	42"	57"
Size Iron	⅞"	9/32"	11/32"	7/16"	15/32"	23/32"	27/32"
Breaking Strain ..... Pounds	1,200	4,000	6,000	10,500	12,500	15,000	19,000

Fig. 656

The jaws of the Ideal Wrench have two kinds of biting surfaces; Regular Jaws for all straight surfaces, such as pipe, etc.; V shaped jaws (inside biting surface) for fittings, valves, flanges or castings of every description; grips all surfaces at two points, **no one-sided gripping.**

Quick adjustment. All slack of chain taken up between chain support and front of jaws. Radius of biting surface enables operator to obtain many more grips than with other wrenches.

Perfect chain lock; never binds. Holds chain firmly.

Quick Repairs. Simply remove loose steel pin, discard broken links and re-attach rest of chain. **A great time saver.** All parts interchangeable.

Jaws, drop forged of high grade tool steel, easily tempered and sharpened when necessary.

Can be fitted to any discarded wrench handle or bar. Jaws reinforced over handle; no strain on bolts.

Chain, of Norway iron (will stretch before breaking), held by loose steel pin.

Handle, extra heavy (round steel), **very stiff.**

Strength and durability combined with lightness, easy to handle, and fully guaranteed.

THE IDEAL CHAIN WRENCH

GRIPS EVERYTHING.

Pipe, Fittings, Valves, Flanges

"EVERY FLORIST SHOULD HAVE IT"

DIMENSIONS AND WEIGHTS

Number of wrench. ..	2	3	4	5
Capacity size pipe	⅛ to 3½	1 to 5	2 to 8	2½ to 12
Capacity size fittings ...	⅛ to 3	1 to 4	2 to 6	2½ to 10
Length of wrench	27	38	49	61
Weight of wrench .	10 lbs.	18 lbs.	28 lbs.	50 lbs.
Size and length cable chain ..	$\frac{5}{32}$x20	$\frac{13}{64}$x30	$\frac{15}{64}$x35	$\frac{19}{64}$x50
Size and length flat link chain	$\frac{9}{160}$x23	$\frac{5}{32}$x30	$\frac{11}{64}$x37	$\frac{13}{64}$x53

LIST PRICES

Wrench with cable chain.	$6.00	$8.00	$11.00	16.00
Jaws complete with bolts and pins...	3.50	5.00	6.50	8.25
Jaws, right or left, each .	1.63	2.25	2.93	3.75
Bolts, each.....	.20	.25	.30	.35
Pins (Vanadium steel) each	.15	.20	.25	.30
Cable chain (Norway iron).	.95	1.20	1.70	3 00
Flat link chain	2.00	3.00	4.00	6.00
Wrench with cable chain	6.90	9.20	12.65	18 40
Handle, each	2.10	3.25	4.75	6.90

SAUNDERS' PIPE CUTTERS

Fig. 176

Number.....	1	2	3	4
Cuts Pipe from.....Inches	⅛ to 1	1 to 2	2 to 3	2½ to 4
Price, Complete.....Each	3.00	4.50	11.00	18.00
Price, Extra Wheels.....Each	.24	.32	.60	.60
Price, Extra Rollers.....Each	.24	.32	.50	.50
Price, Extra Pins.....Each	.10	.10	.15	.15
Price, Extra Blocks and Wheels.....Each	1.25	1.75	2.75	3.50

BARNES' THREE-WHEEL PIPE CUTTERS

Fig. 177

Number.....	1	2	3	4	5
Cuts Pipe from .....Inches	⅛ to 1	½ to 2	1½ to 3	2½ to 4	4 to 6
Price .....Each	4.50	6.00	10.00	20.00	30.00
Extra Cutter Wheels.....Each	.25	.30	.40	.50	.75
Extra Wheel Pins .....Each	.10	.10	.10	.20	.20
Extra Handles .....Each	1.00	1.25	2.25	4.50	7.00

WRENCHES MONKEY

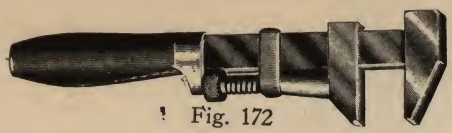


Fig. 172

Size.....Inches	6	8	10	12	15	18	21
Black, Price.....Per dozen	9.00	10.00	12.00	14.00	24.00	30.00	36.00

COMBINATION PLYERS

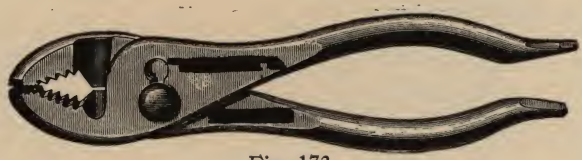


Fig. 173

GAS PLYERS, WIRE CUTTERS, WRENCH AND SCREW DRIVER COMBINED

Size.....Inches	6	10
Price, Black.....Per dozen	13.50	18.00
Price, Plated.....Per dozen	15.00	21.00

PARMELEE'S WRENCH

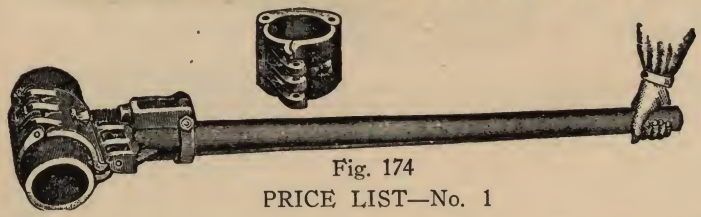


Fig. 174

PRICE LIST—No. 1

Stock, 10-in. .....each, $1.00
Girths for ⅛, ¼, ⅜, ½, ¾ and 1 inch I. S. Pipe.....each, .75
Girths for ⅝, ¾ and ⅞ inch F. T. Tubing.....each, .75

PRICE LIST—No. 2

Stock, 20-in. .....each, $1.50
Girths for ¾, 1 and 1¼ inch I. S. Pipe.....each, 1.00
PARTS—Base, Center and Lip.....each, .35

PRICE LIST—No. 2½

Stock, 20-in. .....each, $2.00

PARTS

Rotating Handle.....$1.00 Fulcrum.....$1.00 Lock Bolt.....$0.25

Girths for Nos. 2 and 2½ are adjustable to Nos. 3 or 3½ Stocks.

PRICE LIST—No. 3

Stock, 20-inch .....each, $2.00
Girths for 1½, 2, 2½ and 3 inch I. S. Pipe.....each 1.25

PARTS

Base, Center and Lip.....each, .45

No. 3½

A brace, attached to Nos. 3 and 3½ stocks, is designed to impinge against a stop on girth to relieve the fulcrum and girth from undue strain of the gripping device.

The brace should always be used when an extra leverage is put over the stock.

Stock, complete, 25-inch.....each, $2.50

PARTS

Rotating Handle..$1.10 Fulcrum.....$1.15 Lock Bolt.....$0.25 Brace.....$0.25

TRIMO PIPE WRENCHES

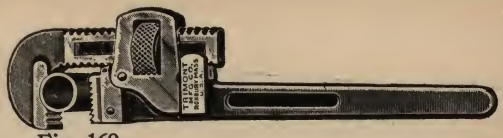


Fig. 169

Length open ...Inches	6	8	10	14	18	24	36	48
Takes from.....	⅛ inch wire to ½ inch pipe.	⅛ inch wire to ¾ inch pipe.	⅛ inch wire to 1 inch pipe.	¼ inch wire to 1½ inch pipe.	¼ inch wire to 2 inch pipe.	¼ inch wire to 2½ inch pipe.	½ inch pipe to 3½ inch pipe.	1 inch pipe to 5 inch pipe.
Price .....Each	2.00	2.00	2.25	3.00	4.00	6.00	12.00	18.00
Jaws.....Each	.67	.67	.75	1.00	1.33	2.00	4.00	6.00
Nuts.....Each	.20	.20	.27	.35	.42	.50	.65	.80
Inserted Jaws....Each	.25	.25	.33	.50	.55	.65	1.00	1.25
Frames.....Each	.25	.25	.33	.45	.55	.65	.75	1.00

In ordering parts state the size of Wrench.

BEMIS AND CALL'S COMBINATION WRENCHES

WITH LONG NUT

Fig. 170

Size.....Inches	8	10	12	15	18
Adjustable to Pipe.....Inches	¼ to ¾	⅛ to 1	½ to 1½	½ to 2	½ to 3
Price Bright with Long Nut..Per Doz.	23.00	25 25	28.50	40.50	72.00
Extra Slides with Dog.....Net each	.30	.38	.45	.60	.90
Extra Steel Dogs or Jaws ...Net each	.12	.15	.18	.23	.30
Extra Nuts .....Net each	.12	.15	.18	.23	.30
Extra Sleeves .....Net each	.18	.23	.30	.38	.53
Extra Tips and Ferrules .....Net each	.03	.03	.03	.05	.06
Extra Wood Handle with Ferrule and Tip .....Net each	.09	.09	.11	.13	.15

In Ordering Extra Parts Always Give Length of Wrench.

STILLSON'S PIPE WRENCHES

PIPE IS NOT CRUSHED BY ITS USE

Fig. 171

Length, open .. Inches	6	8	10	14	18	24	36	48
For Sizes Pipe..Inches	⅛ to ½	⅛ to ¾	⅛ to 1	¼ to 1½	¼ to 2	⅛ to 2½	¼ to 3½	1 to 5
Price .....Each	2.00	2.00	2.25	3.00	4.00	6.00	12.00	18.00
Extra Frames.....Each	.35	.35	.40	.50	.55	.80	1.30	1.50
Extra Nuts .....Each	.11	.11	.14	.17	.22	.35	.55	.95
Extra Jaws .....Each	.75	.75	.80	1.00	1.33	2.10	4.75	7.25

CARPENTER'S TOOLS

Fig. 703

SAWS

	18″	20″	22″	24″	26″
CROSS CUT Each	$1.45	$1.60	$1.75	$1.85	$2.10
RIP Each				26″ $2.10	28″ $2.75

SMOOTHING PLANES

	No. 2	No. 3	No. 4	No. 5 Jack	No. 6 Fore	No. 7 Jointer	No. 8 Jointer
Each	$1.80	$1.90	$2.00	$2.15	$2.75	$3.50	$4.00

BLOCK PLANES

No. 120.....$0.75 No. 9½.....$0.90 No. 18.....$1.15 No. 65.....$1.25

HAMMERS

No. 1.....$0.80 No. 1½.....$0.75 No. 2.....$0.70 No. 3.....$0.65

RATCHET BRACES

No. 1.....$1.25 No. 2.....$1.45 No. 3.....$1.55 No. 4.....$2.15 No. 5.....$2.80

STEEL SQUARES

No. 1.....$0.95 No. 2.....$1.05 No. 3.....$1.40

LEVELS

	No. 1	No. 2	No. 3	No. 4
24″, 26″ or 28″	$1.25	$1.55	$2.10	$2.75
Pocket Levels	.40	.50		

AUGUR BITS

Size	Price	Size	Price	Size	Price
3/16″	$0.30	1/2″	$0.40	13/16″	$0.60
1/4″	.30	9/16″	.50	7/8″	.60
5/16″	.30	5/8″	.50	15/16″	.70
3/8″	.35	11/16″	.55	1″	.75
7/16″	.40	3/4″	.55		

LOW PRESSURE
BRASS POP SAFETY VALVES
FOR STEAM HEATING BOILERS
SET AT ANY PRESSURE SPECIFIED UP TO 20 POUNDS

These Valves are made of brass, with a strong and durable base, and are fitted with best steel springs.

In addition to their extensive use on Steam Heating Boilers, they are also useful on Boiling Kettles, Tanks, etc.

When not otherwise specified we will furnish No. 1160 rough body Valves set at 10 pounds.

Fig. 720.

No. 1160 No. 1162

Size.............. .... .Inches	¾	1	1¼	1½	2	2½
No. 1160. Rough Body...........Each	7 00	8.00	9.00	11.00	15.00	35.00
No. 1162. Finished......... .....Each	8.00	9.00	10.25	12.50	17.00	38.00
No. 1164, Finished and Nickel Plated. ....Each	9.00	10.00	11.50	14.00	19.00	40.00

STANDARD WATER RELIEF VALVES

Fig. 722.

Standard—Brass

SIZES AND PRICES, BRASS

Size, inches ..	½	¾	1	1¼	1½	2
Price, each....	10 00	10 00	12 50	15 50	19 00	28 00
Size, inches ..	....	2½	3	3½	4	.....
Price, each....	......	52 00	90 00	125 00	150 00	......

Valves will be furnished with regular male base up to 2½ inches and with female base from 3 to 4 inches.

Always specify the pressure valves are to be set.

ENGINEERS' POCKET RULES

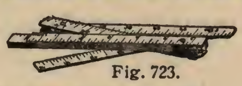


Fig. 723.

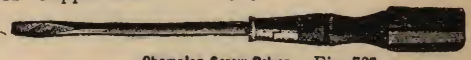
Hardwood. Spring Joints. Brass Tips.

2 foot, Yellow Finish. ⅝ in. wide ....each	0 40
3 " " " ⅝ " " .... "	50
4 " " " ⅝ " " .... "	65
5 " " " ⅝ " " .... "	85
6 " " " ⅝ " " .... "	1 00

If with White Finish, add 20¢ to list.

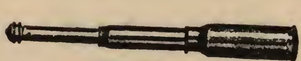
Approximate scale range, 0° to 220° F. (mercury tubes) Fig. 721.
silvered brass scales, black filled figures.

		8″	Price per dozen ½ doz. in a box 10″	12″	¼ doz. in a box 14″
No. 5401	Black japanned heavy tin case.	$10.00	$13.00	$16 00	$20 00
No. 5401P	Copper case.....	13.50	16.50	19.50	24.50

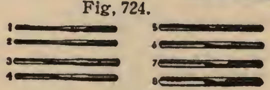


Champion Screw Driver Fig. 725.

Length of Blade, inches....	2½	3	4	5	6	7	8	9	10	12
Price ....each	0 28	0 30	0 40	0 45	0 50	0 60	0 70	0 75	0 85	1 00



Fig, 724.



Automatic Hand Drills

Length without drill point 10 inches. Drill points enclosed in numbered compartments in handle.

Dull Finish, each....... ....1 50
Polished and N. P., each. 2 50

AUTOMATIC SCREW DRIVERS

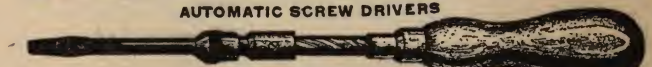


Fig 726.

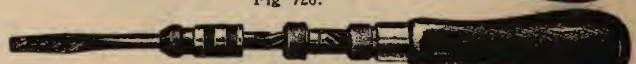


Fig 727.

No. 1, Length, 7½ inches, extended 14 inches, including Three Bits..................	each	1 75
" 2, " 8¼ " " 16 " " " "	"	2 00
" 3, " 9½ " " 18 " " " "	"	2 25
Extra Bits..	"	20
Reversible Automatic, length 9 inches, extended 13½ inches, including Three Bits . .	"	2 50

THE FIFIELD AUTOMATIC DRILLERS

Fig. 711.

No. 2 Has Universal Chuck Fitting Any Drill

SELF-FEEDING

FOR USE IN A BIT BRACE BY ALL CLASSES OF MECHANICS

No. 1, without Drills.....each 5 00
No. 2, " " ..... " 6 25
Universal Chuck for Round and Square Shank Drills for No. 1 .....each 1 25
Solid Chuck for Square Shank Drills for No. 1 .....each 60

STEEL SCOOPS.

Fig. 715.

Ames' Steel, Black.

22-inch Handle, for Locomotives.

Nos.....	2	3	4	5	6	7	8	9	10
Width, inches.....	11	11½	12	12½	12½	13½	14	14½	15
Length, ...	15	15½	16	16½	17	17	17½	18	18½
Per dozen.....	$13 00	13 25	13 75	14 00	14 50	15 00	15 50	16 25	17 00

We carry Nos. 3 to 8 in 26-inch handle at same list; polished, 50 cents per dozen extra.

We also carry Re-enforced Scoops with strap riveted on back of blade at $1.00 per dozen extra. Extra Re-enforced, $2.00 per dozen extra.

POLISHED DRAIN SPADES.

Ames.

Fig. 716.

Length.....	16 in.	18 in.	20 in.	22 in	24 in.
No. 9.....per doz.,	$13 25	13 75	14 00	14 00	15 25

POST AUGERS.

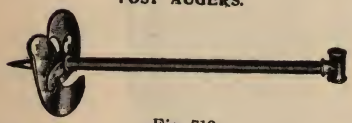
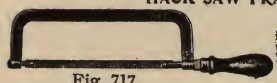


Fig. 712

4, 5, 6, 7, 8 or 9-inch..... .....per doz., $18 00

HACK SAW FRAMES.



The saws may be set to cut in either of four directions and tightened by simply turning the handle.

Fig. 717.

8 inch, with one blade, each...$0 70
9 " " " " " ... 75
10 " " " " " ... 80
11 inch, with one blade, each...$0 85
12 " " " " " ... 90

POST HOLE DIGGERS.

Eureka.

Fig. 713.

Price.....per doz., $15 00

HACK SAW BLADES.

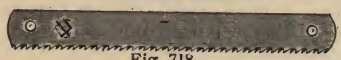


Fig 718.

Starrett.

No. 103.

With common teeth, 18 to the inch.

Length, inches.....	6	7	8	9	10	11	12
Per dozen.....	$0 59	$0 63	$0 67	$0 75	$0 83	$0 92	$1 00
Per gross.....	7 00	7 50	8 00	9 00	10 00	11 00	12 00

Discount, ...

The 6, 7, 8 and 9-inch saws are ⅝ inch wide, .022 inch thick the 10, 11 and 12-inch are ½ inch wide, .022 inch thick.

PRESSURE AND VACUUM GAUGES

STEAM OR PRESSURE GAUGES

BOURDON SINGLE SPRING

Fig 714.

PRICES FOR GAUGES OF 500 LBS. PRESSURE OR LESS INCLUDING COCK

Diameter of Dial, inches.....	3 or less	3½	4 and 4½	5	5½	6	6¾	8½	10	12
Brass Case, Lacquered.....each.	8 00	9 00	10 00	11 00	12 00	16 00	20 00	30 00	40 00	75 00
Nickel-plated Case..... "	8 60	9 75	11 00	12 00	13 25	17 50	22 00	32 50	43 00	79 00
Iron Case with Brass Ring... "	6 00	7 00	8 00	8 00	10 00	13 00	16 00	22 00	32 00	50 00
" " " N. P. " "	6 15	7 18	8 20	10 25	13 50	16 60	22 75	33 00	51 50	

Gauges should indicate about double the working pressure. Not warranted unless Syphon is used.

WHEEL BARROWS

Fig. 719.

GREENHOUSE BARROW

This is a narrow barrow for use in the aisles of a greenhouse. Box 14 inches front, 17 inches back and 12 inches deep. Handles 4 feet 8 inches long. Spread of handles at hand hold 20 inches, 18-inch diameter wheel. Nicely painted and striped.

Price, per dozen 72 00

STEEL TOOL CHESTS

Fig. 690

Made from 1/16-inch cold rolled steel with malleable iron corner pieces and hardwood braces; fitted with heavy wrought iron hinges and hasps. Each steel chest is furnished with a first-class lock and two keys and bolts to screw down cover at front corners.

No.	Depth, Inches	Width, Inches	Length, Inches	Description	Weight, Pounds	List
711	11	12	24	One drawer	60	$12.50
712	14	15	30	One drawer	90	17.00
713	16	17	36	One drawer	125	19.00
721	11	12	24	Two drawers	65	14.00
722	14	15	30	Two drawers	100	18.50
723	16	17	36	Two drawers	130	20.50
701	11	12	30	Without drawer	70	12.50
702	11	12	36	Without drawer	105	15.00
703	11	12	42	Without drawer	140	17.00
704	11	12	48	Without drawer	180	20.00

WOOD TOOL CHESTS

Made of selected seasoned lumber throughout. All corners protected by heavy iron. Stationary till at one side for small tools. No. 789 has strong spring lock while No. 790 has two heavy hasps for padlock.

No.	Depth, Inches	Width, Inches	Length, Inches	Weight, Lbs.	List
789	12	16	24	50	$12.50
790	12	16	36	60	18.50

OX BOW HANGERS AND CHAIN

List price, Chain, 100 feet $5.25

List price, Ox Bow Hanger, 100 pieces..$4.50

Fig. 680

RING AND PERFORATED BAR HANGER

Price List of Rings:

½"	$0.08
¾"	.08
1"	.09
1¼"	.10
1½"	.12
2"	.14
2½"	.16
3"	.18
4"	.25

Fig. 681

YOU WANT A SMOOTH JOB

When you ream pipe you want a reamer that cuts. A reamer that drags over the burrs and flattens or spreads them is little better than no reamer at all. The Mueller Reamer, shown in this folder, *cuts the burrs off clean*—no dragging, no spreading—ust a nice clean shave.

Fig. 682

List Price, Extension Bar. Per foot..... .....10 cents

MUELLER PIPE REAMER

Fig. 686

Ratchet pattern, list price....$7.50
Plain pattern, list price..... 5.00

EUREKA ROSE STAKE FASTENERS

Fig. 683

Fig. 684

No. 1. Per 1000 pieces.....$2.80
No. 2. Per 1000 pieces..... 1.50
Write for discount.

JUST WHAT YOU ARE LOOKING FOR

Fig 685
Patent Applied For

IDEAL PIPE CLAMP

For rust holes and split pipes. Will stand any pressure. Can be applied by any one. Always ready to use, no nuts and bolts required.

THESE CLAMPS ARE MADE OF MALLEABLE IRON

They are made in 2 halves, rights and lefts, which slide into each other, and close on the pipe. To apply to a pipe, cut a piece of packing large enough to cover the break, place one-half of the clamp over it. Slide the other half in place and drive tight.

Prices subject to Discount.

¾	1	1¼	1½	2	2½
$0.45	$0.50	$0.60	$0.70	$0.80	$1.00

GREENHOUSE PIPE AND FITTINGS

FIVE-FOOT LENGTHS

SINGLE HUB

FIG. 200

Size..... inches	2	3	4	5	6	7	8	10	12
Price, Standard.. per foot	.26	.32	.42	.60	.75	1.00	1.25	2.00	3.00
" Extra Heavy	.40	.65	.85	1.15	1.35	1.75	2.25	3.00	4.00

DOUBLE HUB

FIG. 201

Size..... inches	2	3	4	5	6	7	8	10	12
Price, Standard.. per foot	.32	.38	.48	.70	.90	1.15	1.45	2.40	3.50
" Extra Heavy "	.46	.71	.91	1.25	1.50	1.95	2.55	3.60	4.60

BENDS

QUARTER FIFTH SIXTH EIGHTH SIXTEENTH

FIG. 219 FIG. 220 FIG. 221 FIG. 222 FIG. 223

Size..... inches	2	3	4	5	6	8	10	12
Price, Standard..... each	.45	.70	1.00	1.75	2.25	4.00	5.00	8.00
" Extra Heavy..... "	.65	1.00	1.30	2.20	3.25	5.00	6.00	10.00

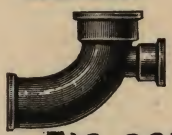
QUARTER BENDS

SIDE INLET

Right Hand Side Inlet

FIG. 202

HEEL INLET



Heel Inlet

FIG. 203

Size.....inches	2	3	4	4	5	5	6	6	6	8	10	12
Inlet..... inches	2	2	2	3	2	3	2	3	4	4	4	4
Price, Standard.... each	1.45	1.70	2.00	2.25	2.75	3.00	3.25	3.50	3.75	5.50	6.50	9.50
" Extra Heavy "	1.55	2.00	2.30	2.55	3.20	3.45	4.25	4.50	4.75	6.50	7.50	11.50

GREENHOUSE FITTINGS

CROSS

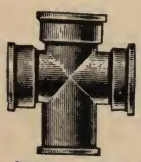


FIG. 210

SANITARY CROSS

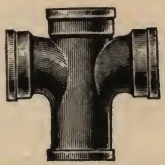


FIG. 211

"Y" BRANCH

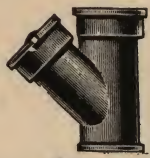


FIG. 212

HALF "Y" BRANCH

FIG. 213

CROSSES

Size.....inches	2x2	3x2	3x3	4x2	4x3	4x4	5x2	5x3	5x4	5x5
Price.....each	1.40	2.05	2.05	2.60	2.60	2.60	3.35	3.35	3.35	3.35

Size.....inches	6x2	6x3	6x4	6x5	6x6	7	8	10	12	....
Price.....each	5.25	5.25	5.25	5.25	5.25	7.50	9.00	15.00	21.00	....

SANITARY CROSSES

Size.....inches	2x2	3x2	3x3	4x2	4x3	4x4	5x2	5x3	5x4	5x5
Price.....each	1.40	2.05	2.05	2.60	2.60	2.60	3.35	3.35	3.35	3.35

Size.....inches	6x2	6x3	6x4	6x5	6x6	7	8	10	12	....
Price.....each	5.25	5.25	5.25	5.25	5.25	7.50	9.00	15.00	21.00	....

"Y" AND HALF "Y" BRANCHES

Size.....inches	2x2	3x2	3x3	4x2	4x3	4x4	5x2	5x3	5x4	5x5
Price.....each	.70	1.25	1 25	1.75	1.75	1.75	2.25	2.25	2.25	2.25

Size.....inches	6x2	6x3	6x4	6x5	6x6	7	8	10	12	....
Price.....each	3.50	3.50	3.50	3.50	3.50	5.00	6.00	10.00	14.00	....

RETURN BENDS

SINGLE HUB

FIG. 214

DOUBLE HUB

FIG. 215

SINGLE HUB

FIG. 216

DOUBLE HUB

FIG. 217

REDUCER

FIG. 218

RETURN BENDS

Size.....inches	2	3	4	5	6
Price, Single Hub.....each	.80	1.55	2.15	3.15	3.75
" Double " ..... "	1.10	1.85	2.45	3.65	4.25

SINGLE AND DOUBLE HUBS

Size.....inches	2	3	4	5	6	7	8	10	12
Price.....each	.30	.60	.75	1.00	1.25	2.50	2.50	3.50	5.00

REDUCERS

Size.....inches	3x2	4x2	5x2	5x3	5x4	6x2	6x3	6x4	8x3
Price.....each	.70	.90	1.15	1.15	1.15	1.25	1.25	1.25	2.50

Size.....inches	8x4	8x5	8x6	10x6	10x8	12x6	12x8	12x10	.....
Price.....each	2.50	2.50	2.50	4.50	4.50	6.25	6.25	6.25	.....

GREENHOUSE FITTINGS

DOUBLE HUB BENDS

QUARTER

FIG. 224.

EIGHTH

FIG. 225

SIXTEENTH

FIG. 226

Size.....inches	2	3	4	5	6
Price.....each	.75	1.00	1.30	2.25	2.75

"T" BRANCH

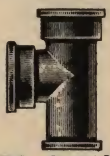


FIG. 227

"T" BRANCH Side Inlet

FIG. 228

"T" BRANCH Hub Ends

FIG. 229

"T" BRANCHES

Size.....inches	2x2	3x2	3x3	4x2	4x3	4x4	5x2	5x3	5x4	5x5
Price.....each	70	1.25	1.25	1 75	1.75	1.75	2.25	2.25	2.25	2.25
Size.....inches	6x2	6x3	6x4	6x5	6x 6	*7	*8	*10	*12	
Price.....each	3.50	3.50	3.50	3.50	3.50	5.00	6.00	10.00	14.00	.....

*Straight and Reducing Sizes. Price Extra for Brass Trap Screws, 2.50.

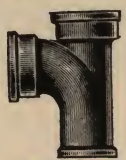
"T" BRANCHES, SIDE INLET

Size of Inlet.....inches	2	3	4
Price, Extra for Inlets to be added to above list of "T" Branches each	1.00	1.25	1.50

"T" BRANCHES, HUB ENDS

Size.....inches	4	5	6
Price.....each	2.35	3.25	4.50

SANITARY "T" BRANCH



SANITARY "T" BRANCH Side Inlet

FIG. 230 SANITARY "T" BRANCHES FIG. 23

Size.....inches	2x2	3x2	3x3	4x2	4x3	4x4	5x2	5x3	5x4	5x5
Price.....each	.70	1.25	1.25	1.75	1.75	1.75	2.25	2,25	2.25	2.25
Size.....inches	6x2	6x3	6x4	6x5	6x6	*7	*8	*10	*12	....
Price.....each	3.50	3.50	3.50	3.50	3.50	5.00	6.00	10.00	14.00	....

*Straight and Reducing Sizes. Price Extra for Brass Trap Screws, 2.50.

SANITARY "T" BRANCHES, SIDE INLET

Size of Inlet.....inches	2	3	4
Extra for Inlets to be added to above list of Sanitary "T" Branches each	1.00	1.25	1.50

GREENHOUSE FITTINGS

STRAIGHT SLEEVES

Fig. 657

	Size	Standard	Extra Heavy
H-1533.	2 inch	$0.35	$0.50
H-1533.	3 inch	.60	.80
H-1533.	4 inch	.75	.95
H-1533.	5 inch	1.00	1.35
H-1533.	6 inch	1.25	1.60
H-1533.	8 inch	2.50	3.50
H-1533.	10 inch	3.50	4.50
H-1533.	12 inch	5.00	8.00

REDUCERS

Fig. 659

Size	Standard	Extra Heavy
3 to 2 inch	$0.70	$1.00
4 to 2 inch	.90	1.25
4 to 3 inch	.90	1.25
5 to 2 inch	1.15	1.75
5 to 3 inch	1.15	1.75
5 to 4 inch	1.15	1.75
6 to 2 inch	1.25	2.25
6 to 3 inch	1.25	2.25
6 to 4 inch	1.25	2.25
6 to 5 inch	1.25	2.25
8 to 3 inch	2.50	4.25
8 to 4 inch	2.50	4.25

PLUGS OR STOPPERS

Fig. 662

	Size	Standard	Extra Heavy
H-1532.	2 inch	$0.15	$0.25
H-1532.	3 inch	.25	.35
H-1532.	4 inch	.30	.50
H-1532.	5 inch	.40	.75
H-1532.	6 inch	.50	1.00
H-1532.	8 inch	1.20	1.50
H-1532.	10 inch	2.00	3.00
H-1532.	12 inch	3.00	4.00

"H" BRANCH

Fig. 658

THREE HUBS

H-1590. 4 inch.....$2.25

DOUBLE ELBOWS

Fig. 660

H1591. 4 inch.....$3.25

TRIPLE ELBOWS

Fig. 661

H-1593. 4 inch.....$4.50

QUADRUPLE ELBOWS

Fig. 663

H-1592. 4 inch.....$5.75

GREENHOUSE FITTINGS

Return Bend

Fig. 664

Hub Outlet

H-1588. 4 inch.....$2.75

Three-Way Branch Tees

Fig. 665

H-1594. 4 inch.....$5.00

Increasers for Calking

Fig. 666

Size	Standard	Extra Heavy
2 to 3 inch	$0.70	$1.00
2 to 4 inch	.90	1.25
2 to 5 inch	1.15	1.75
2 to 6 inch	1.25	2.25
3 to 4 inch	.90	1.25
3 to 5 inch	1.15	1.75
3 to 6 inch	1.25	2.25
4 to 5 inch	1.15	1.75
4 to 6 inch	1.25	2.25
5 to 6 inch	1.25	2.25
5 to 8 inch	2.00	5.00
6 to 8 inch	2.00	5.00
6 to 10 inch	4.00	6.50
8 to 10 inch	4.00	6.50
8 to 12 inch	6.00	8.50
10 to 12 inch	6.00	8.50

Greenhouse Butterfly Valve

Fig. 667

H-1596. 4-inch, net.....$3.50

Oakum, Best Grade

Fig. 668

List price, per pound.....$0.10

Greenhouse Valve

Has 4 Inch Waterway

Fig. 669

H-1595. 4 inch, Net.....$6.00

Steam Traps

The returning of hot water of condensation from heating, drying or cooking systems directly into boilers by means of return traps of various types is not the application of a new principle, as the idea, in varied ways, has been used for about a quarter of a century, although not extensively until quite recently.

The principle is correct, simple and worthy of general application to all classes of installations, such as large steam heating plants, schools, greenhouses, laundries, public buildings and residences. Heretofore architects and engineers have not specified return traps to the extent that their efficiency would really warrant.

What the Return Trap is

The return trap is a device which receives the water of condensation from whatever source, and automatically delivers it into the boiler at practically the temperature due to the pressure at which the steam is condensed. Condensation must be removed. The quicker it is removed, the drier and more effective will be the heating surfaces. It is pure water and hot, and it is gross extravagance to waste it. The most effective way to utilize the heat it contains is to deliver it into the boiler before it vaporizes. In no other way can the condensation be handled so quickly and with the same efficiency as with a good return trap.

Better Than a Pump

A return trap will deliver water at a temperature higher than a pump will lift. A pump consumes an extravagant amount of steam to do a very little work. For example, an ordinary duplex boiler feed pump requires from 90 to 120 pounds of steam per horse power. A return trap consumes less than 10 pounds per horse power. The pressure is admitted to the surface of the water and is automatically shut off before the tank is empty. The steam used is only such as is condensed by the latent heat passing from it into the water in the tank, which is all put back into the boiler.

Steam Traps

Return Trap System

Method of Operation

All the drips or returns from whatever source are brought into a closed receiver placed at any convenient point low enough so that all returns will drain into same by gravity.

The receiver acts as a collecting chamber, keeping the returns thoroughly drained during the momentary hold-up while the trap is discharging.

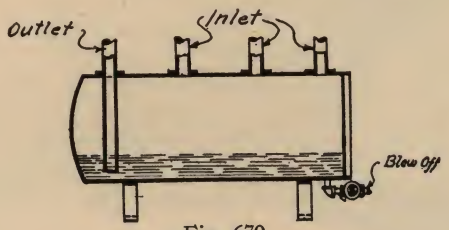


Fig. 670

Receivers are specially designed for this use, Fig. 5 showing the internal construction. The supplypipe to the steam trap extends nearly to the bottom of the receiver. Water is supplied to the trap, even though but a small quantity is being condensed; also condensation is allowed to collect in the receiver when the trap is discharging, this being delivered to the trap as soon as it resumes its filling position.

The water is elevated out of the receiver into the trap because of the fact that for every pound of steam pressure carried on the system being drained, the water can be lifted two feet high out of the closed receiver. This is approximately correct and is based on the fact that a column of water exerts a pressure at its base due to its weight of one pound per square inch for each 27.67 inches height, regardless of its size or shape. (See footnote.)

NOTE.—There are some cases where one pound pressure for each two feet lift will not be sufficient, because of excessive friction due to the angles of the return pipes, valves, elbows, etc., which must be overcome in delivering the water to the trap, so due judgment should be exercised when installing traps under such conditions. It is wise to be fairly liberal in these calculations in any event, as the capacity of return traps is accelerated or retarded in proportion to the pressure, or head, on the water that is being delivered to the trap.

Steam Traps

Return Trap System

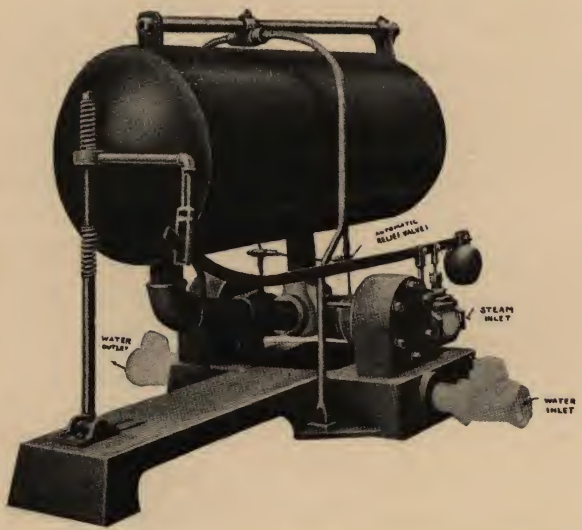


Figure 3

Automatic Return Steam Trap.
(Patented)

Figure 4

Receiver used in connection with Return Traps.

"Trapping steam and returning condensation to boilers without pumping means dollars saved in the coal pile."

"Detroit" Return Traps

For Coil Drainage, Water Lift and Automatic Boiler Feed.
Price List, Capacities and General Dimensions

Size Trap	LIST PRICE		Water Inlet and Outlet	Size Steam Inlet	CAPACITY				Approximate Shipping Weight	Telegraphic Code Word
	Trap Only	Trap and Receiver			Pounds per Hour	Sq. Ft. Direct Radiation	Lineal Ft. 1" Pipe Direct Radiation	Lineal Ft. Hot Blast Coil		
10	$ 80.00	$ 90.00	¾"	½"	830	2800	8400	1250	275	Dabbler
11	105.00	125.00	1	¾"	1500	5000	15000	2250	325	Dabble
12	150.00	170.00	1¼	1	2500	8300	25000	3750	425	Dabster
13	200.00	225.00	1½	1¼	5000	16500	50000	7500	500	Dacapo
14	275.00	300.00	2	1½	.6600	22000	66000	10000	700	Dactyl
15	360.00	385.00	2½	2	15000	50000	150000	21000	900	Daddock
16	450.00	475.00	3	2	24000	80000	240000	36000	1000	Dagger

NOTE.—No check valves, gate valves or pipe fittings are included with Traps. Such items, when furnished by us, are extra.

Capacities are based on average direct radiating conditions. Extreme conditions, such as obtain in greenhouses, dryers for wet goods, blower systems, etc., should be referred to our Engineering Department for selection of size. Florists should specify amount of glass surface in greenhouses.

NOTE.—Always obtain steam pressure carried—this is important and should be specified on all inquiries and orders.

Price List Morehead and Taylor Tilting Return Steam Traps

No.	Size of Drum	Size of Inlet and Outlet Connections Inches	Size of Steam Pipe Connections Inches	Capacity of Water in Lbs. per Hour	Drainage Capacity in feet of 1 inch Pipe Lineal	Capacity Square Feet Direct Radiation	Capacity Lineal Feet Hot Blast Heater	Weight	Price
1	10x24	1	1	1050	5000	2300	1000	100	$ 75 00
2	12x30	1¼	1	1850	9000	4000	1800	175	135 00
3	14x36	1½	1¼	4000	20000	9000	4000	250	175 00
4	16x40	2	1¼	6000	35000	16000	7000	275	225 00
5	18x42	2½	2	11000	50000	25000	12000	350	350 00
6	18x42	3	2	15000	75000	40000	18000	400	450 00

The above capacities are figured on a basis of 50 pounds pressure to the square inch. The above drainage capacity in inch pipe is based on ordinary radiating conditions. For lumber kilns, greenhouses and moist goods, divide by two. For laundries, brick dryers and wet goods, divide by three. For fan stacks and blowers, divide by five.

NOTE—3 feet of 1 inch pipe equals one square foot of surface. 2.3 feet of 1¼ inch pipe equals one square foot of surface. 2 feet of 1½ inch pipe equals one square foot of surface. 1.61 feet of two inch pipe equals one square foot of surface.

Price List Morehead and Taylor Receivers

No.	Length Inches	Height Inches	Diameter Inches	Price
1	30	16	10	$18 00
2	40	20	12	25 00

No. 1 Receiver has Capacity for Traps Nos. 1 and 2 No. 2 Receiver has capacity for Traps Nos. 3, 4, 5 and 6.

STEAM TRAPS.

FIG. 189

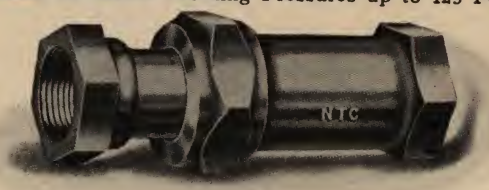
"NASON PATTERN."

NUMBER OF STEAM TRAP.	1	2	3	4	5
Size of Pipe Connections.....inches	¾	¾	1	1¼	1½
Square feet of Surface each will drain.....	350	900	1,400	2,000	3,500
Lineal feet of 1 inch Pipe will drain	1,050	2,700	4,200	6,000	10,500
Height to top of Valve.....inches	11	14	15	18¼	22
Diameter outside of Flanges	11	14	15½	18½	24
Weight.....lbs	46	85	115	185	356
Price.....each	16.00	20.00	27.50	42.50	70.00

STANDARD BRASS EXPANSION JOINTS

Suitable for Steam Working Pressures up to 125 Pounds

Fig. 671



STANDARD TRAVERSE

Size .....inches	½	¾	1	1¼	1½	2	2½	3
Traverse. .....inches	2	2¼	2¼	2¼	2¼	2½	2½	2¾
Each.....	1.50	2.20	2.75	4.00	5.00	8.00	17.50	24.00

SPECIAL TRAVERSE (No. H-866)

Traverse	Size .....inches	¾	1	1¼	1½	2	2½
4 inches.....	Each	4.00	4.90	6.30	7.40	9.10	.....
6 "	"	8.25	9.00	10.00	11.50	13.50	24.00
8 "	"	9.00	10.00	11.25	13.00	15.50	27.00
10 "	"	9.75	11.00	12.50	14.50	17.50	30.00
12 "	"	10.50	12.00	13.75	16.00	19.50	33.00

Under ordinary steam service conditions an allowance of about 1 inch in 50 feet of pipe should be made for expansion.

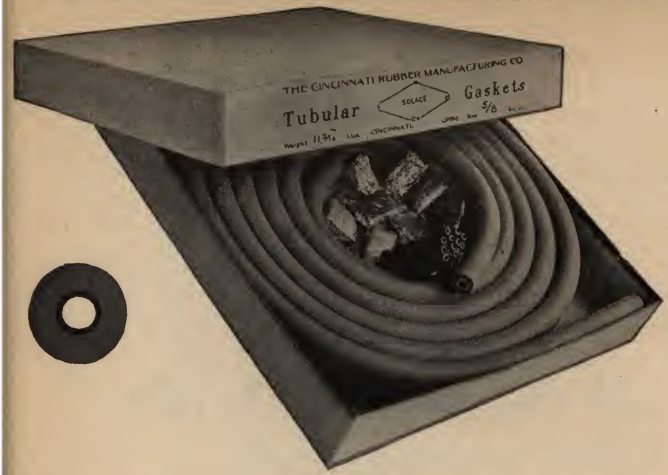


Fig. 672

Packing

Whatever you may need along this line you will find it here at the right price.

Our packing is of the best grade. No cheap substitutes carried in stock by us as it does not pay to stint on this class of goods.

Prompt shipment always and the right goods at the lowest market price.

Fig. 673

Fig. 674

Fig. 675

RAINBOW

FIG. 204

JENKINS' 96

FIG. 205

Fig. 676

JENKINS' 96 SHEET

Thickness, 1/32, 1/16, 3/32, 1/8 and 1/4 inches.....per pound	1.00

RAINBOW RED SHEET

Thickness, 1/32, 1/16, 3/32, 1/8, 5/16 and 1/4 inches.....	1.00

PIPE HOOKS AND STRAPS

GAS PIPE HOOKS

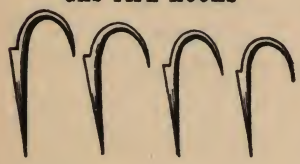


FIG. 191

TINNED STRAPS

FIG. 192

WROUGHT IRON GAS PIPE HOOKS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2
Price.....per 100	.30	.35	.40	.50	.65	.85	1.00	1.30
Weight per 100.....pounds	1	1¼	1¾	3	3¾	6	6	9¼

TINNED PIPE STRAPS

Size.....inches	¼	⅜	½	¾	1	1¼	1½	2
Price.....per pound	.18	.18	.18	.18	.18	.18	.18	.18
Weight per 100.....pounds	1½	1¾	2½	3½	5	7¾	10	11½

ASBESTOS CEMENT

Asbestos Cement, in 100 lb. bags only. Net $1.25 per 100 lbs.

Boiler, Stove, Furnace and Pipe Cement

Price, per pound, Boiler, Stove and Furnace Cement.....$0.10
Smooth on for Castings, per pound..... .50
Smooth on for Pipe Joints, per pound..... .25
Smooth on, Compound No. 1 and No. 2, per pound..... .50
Graphite Compound, for Pipe Joints, per pound..... .25
Flake Graphite, for Pipe Joints, per pound..... .10

SECTIONAL PIPE COVERINGS

ASBESTOS MOULDED COVERING

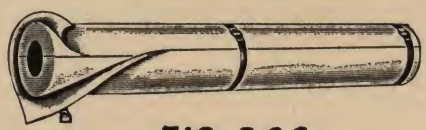


FIG. 206

ASBESTOS MOULDED COVERING FOR PIPE FITTING

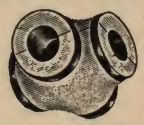


FIG. 207

WOOLFELT COVERING

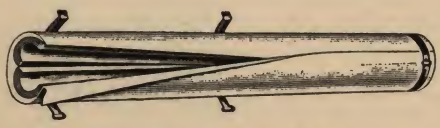


FIG. 208

AIR CELL COVERING

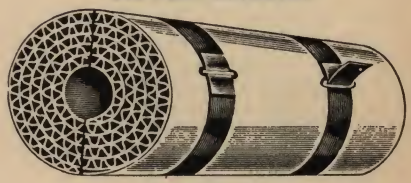


FIG. 209

PIPE AND FITTING COVERINGS

Inside Diameter of Pipe.....inches	½	¾	1	1¼	1½	2	2½	3	3½
Price, Covering.....per foot	.22	.24	.27	.30	.33	.36	.40	.45	.50
" Elbow Covers.....each	.30	.30	.30	.30	.30	.36	.42	.48	.54
" Tee " ..... "	.36	.36	.36	.36	.36	.42	.48	.54	.60
" Cross " ..... "	.48	.48	.48	.48	.48	.55	.60	.70	.80
" Valve " ..... "	.54	.54	.54	.54	.54	.60	.78	.96	1.20

Inside Diameter of Pipe.....inches	4	4½	5	6	7	8	9	10	12
Price, Covering.....per foot	.60	.65	.70	.80	1.00	1.10	1.20	1.30	1.85
" Elbow Covers.....each	.60	.72	.90	1.30	1.80	2.40	3.00	3.60	...
" Tee " ..... "	.75	.90	1.20	1.60	2.20	3.00	3.80	4.60	...
" Cross " ..... "	.95	1.10	1.50	2.00	2.80	3.60	4.40	5.20	...
" Valve " ..... "	1.50	1.85	2.25	2.80	3.60	4.40	5.30	6.20	...

Inside Diameter of Pipe.....inches	14	16	18	20	24	30	...	...	..
Price, Covering.....per foot	2.10	2.35	2.60	2.85	3.30	4.00	...	...	

GREENHOUSE PIPE CARRIERS

Fig. 677

Fig. 678

PRICE LIST

Clamp On	To Carry	Single Hook	Double Hook
1 -inch	1 to 1½-inches	$0.08	$0.09
1 -inch	2 to 2½-inches	.10	.12
1 -inch	3 to 4 -inches	.13	.15
1 -inch	5 to 6 -inches	.13	.16
1¼-inches	1 to 1½-inches	.09	.10
1¼-inches	2 to 2½-inches	.10	.12
1¼-inches	3 to 4 -inches	.13	.15
1¼-inches	5 to 6 -inches	.13	.16
1½-inches	1 to 1½-inches	.09	.10
1½-inches	2 to 2½-inches	.11	.13
1½-inches	3 to 4 -inches	.14	.16
1½-inches	5 to 6 -inches	.14	.17
2 -inches	1 to 1½-inches	.10	.11
2 -inches	2 to 2½-inches	.12	.14
2 -inches	3 to 4 -inches	.15	.17
2 -inches	5 to 6 -inches	.15	.18

These carriers are the best and most simple on the market. Hooks and collars are all interchangeable so that single carriers can be made double any time by purchasing an additional hook. Size of collars can also be changed without purchasing new hooks.

Carriers to clamp on ¾" pipe same price as 1".

Carriers to clamp on larger than 2" pipe made to order.

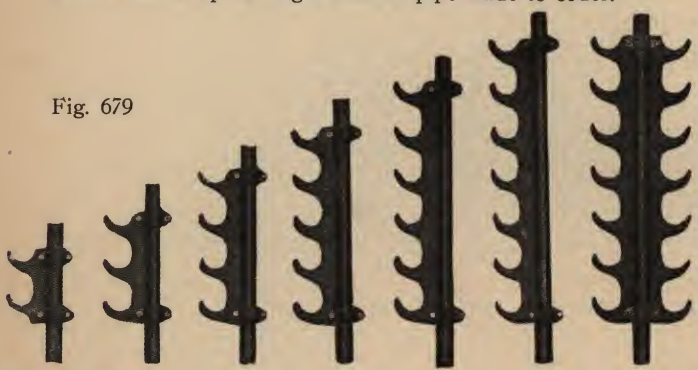


Fig. 679

These Carriers made to clamp on ¾", 1", 1¼", 1½" and 2" pipe.

Larger sizes made to order.

No. of Hooks		2	3	4	5	6	7
For 1" pipe, 2½" between centers	Price	$0.25	$0.35	$0.50	$0.60	$0.70	$0.80
For 1¼" pipe, 3" between centers	Price	.27	.40	.60	.70	.80	.90
For 1½" pipe, 3½" between centers	Price	.40	.60	.75	.90	1.00	1.10
For 2" pipe, 4½" between centers	Price	.60	.85	1.00	1.35	1.55	1.75
			¾"	1"	1¼"	1½"	2"
Collars (2 set—4 pieces) with bolts			$0.16	$0.18	$0.20	$0.22	$0.24

Honeywell Heat Generator

THE HONEYWELL HEAT GENERATOR

Fig. 687

HONEYWELL HEAT GENERATOR

Fig. 688

Honeywell Heat Generator

This mercury generator for hot water heating will in most every case save its cost in fuel in one season. When attached to a gravity system of hot water heating it causes the water to circulate four to five times as fast as it would under ordinary conditions and of course the better the circulation the more heat you will get per pound of coal burned. Every boiler no matter how lengthy its fire travel or how much of its surface is exposed to the fire will permit a certain amount of the heated gases from the coal to escape into the chimney. The reason for this is the water cannot absorb all of the heat thrown off by the fire. The more times you can change the water in the boiler in an hour and the oftener this water passes over your fire in an hour the greater the number of heat units the water will absorb. The generator, therefore, by increasing the circulation causes the water to pass over the heated surface in the boiler four or five times where it only passed over once before and you of course are able to use more of the heat from your fuel than you could otherwise.

Honeywell Heat Generator—Continued

Another thing the generator does is to remedy poor circulation. Your system may have mains and flows that are too small or you may have an usual amount of friction in your coils and piping. With a mercury system the sizes of pipe can be reduced ten per cent under the sizes used for gravity heating and if your pipe is too small the generator, of course, will increase its capacity. This generator creates a pressure on the system ranging from 0 to 10 pounds. Notwithstanding this pressure a generator can be used on most any system of hot water heating. We have several of them attached to systems with cast iron pipe and packed joints. A well packed joint on cast iron pipe will stand the pressure perfectly. With a generator the temperature of the water can be carried as high as 240 degrees without boiling and this is an advantage that cannot be over estimated. In extreme weather and when heat is needed badly you will be able to take care of your houses by forcing the system. We do not advise a high water temperature at the boiler, however, and it should be used only when absolutely necessary. The generator on account of the rapid circulation it creates will enable you to get the heat required in the greenhouse with a lower temperature at the boiler than would be required with the ordinary gravity system. Owing to the low water temperature used and the rapid circulation through the coils there is a tremendous saving not only in fuel but in labor, firing, removing ashes, attending to the boiler, etc.

These generators have been on the market for only a short period of years but there are fully twenty-five thousand of them in use. Everybody who has tried the generator is more than satisfied and no one after using it would go back to the old method for any money. We recommend this generator for all hot water heating systems and guarantee it to give perfect satisfaction. There are four sizes of generators that we carry in stock but larger sizes can be made to order at any time.

The construction and operation of the generator is about as follows:

The lower portion is partly filled with mercury and when generator is connected to the system the balance of the space shown in the sectional cut will be filled with water. While the water in the system is cold the mercury will lie at the bottom of the generator. In the center of the generator is a small tube which extends to the bottom of the pot in which is contained the mercury. The mercury seals the lower opening of this tube effectually. When a fire is started in the boiler the water is heated and begins to expand or increase in volume. This expanded water flows out through the mains into the system and back again into the returns where the excess enters the expansion pipe and then into the generator. After this expanded

Honeywell Heat Generator—Continued

water flows into the generator on the side it enters the lower portion, or pot, presses down on the mercury and forces the mercury to rise in the center tube. As the water continues to be heated and increases in volume the pressure on the mercury in the generator also increases and finally all of it is lifted from the pot through the center tube into the oval shaped upper portion. At the very top of the generator there is a deflector and as the mercury and water overflows the center tube it strikes against this deflector. The water being light continues on its upward journey, passes around the deflector and up through the expansion pipe leading to the tank. The mercury on account of its weight falls back and is carried down again through the outer tube to the mercury pot. When it reaches the lower part of the generator it again seals the center tube and there is continually a pressure on the system. This keeps the pressure always balanced and even. There is no danger of sticking and you will get expansion as soon as the pressure exceeds the weight of the mercury.

The sizes of generators and list prices are as follows:

No. 1. Carries up to 1,200 sq. ft. Radiation.....each $25.00
No. 2. Carries up to 2,500 sq. ft. Radiation.....each 35.00
No. 3. Carries up to 3,500 sq. ft. Radiation.....each 50.00
No. 4. Carries up to 10,000 sq. ft. Radiation.....each 65.00

How to Connect Generator

To get the generator to operate perfectly it must be connected in the right way. Complaints are sometimes sent in saying generator fails to operate and in every instance we have found some mistake has been made in installing it. We have seen generators placed upside down, connected directly beneath expansion tank, connected to flow pipe, or with upper expansion pipe connected on the side and lower one connected to the top of the generator. There is only one way to connect the generator and you cannot get results unless you do it this way.

The cut shows boiler, return pipe and generator. Place the generator as near the boiler as possible. Never connect it directly beneath the expansion tank keeping it at least 30 inches distant. The side opening in the generator should be connected to any return pipe on the system. This pipe should have a union in it for after plugs are removed the generator must be kept in an upright position until all connections are made. Screw a nipple of proper length into the side of generator then connect this nipple with the union on the pipe leading to the return. A union will also be needed in the upper pipe line.

Turn a nipple into the top opening of the generator and make your union connection to the upper line. Do not under any circumstances turn the generator over and over to connect it, for if any of the mercury is lost it will not work as it ought to. This is most important. Do not expect the pipe leading from top of generator

Honeywell Heat Generator – Continued

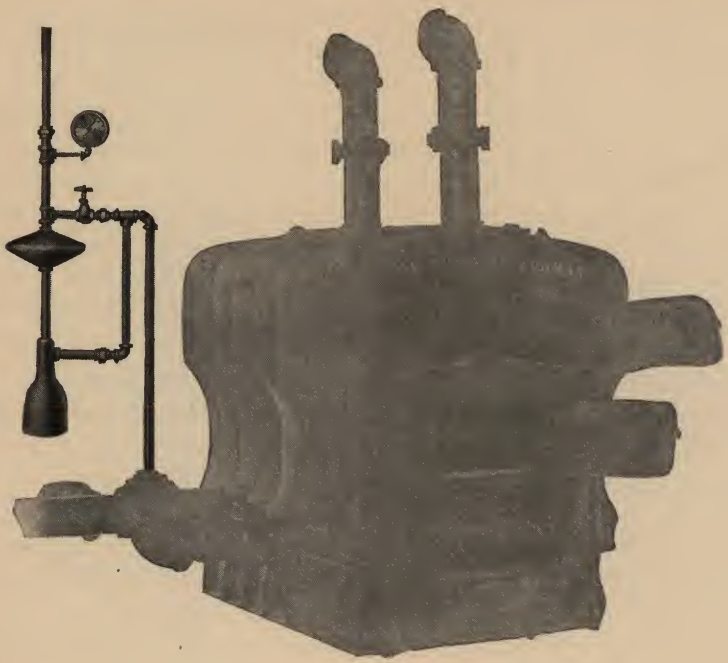


Fig. 689

to expansion tank to get hot as there is no movement of the water above the generator until the pressure on the system exceeds the weight of the mercury. The draw off cock on the boiler should be located on the opposite side of the boiler from the generator. Water can be fed into the system from the expansion tank down through the generator but this is not a good plan and a better way is to connect a supply pipe direct to some one of the main returns.

If you use an altitude gauge to show the height of the water in the tank, place this gauge between the generator and the tank, for when thus connected the pressure produced by the generator will have no effect on the gauge and it will always register the exact height of the water in the system. If altitude gauge is connected to the boiler or to any returns or mains it will simply register the amount of pressure exerted by the generator, in addition to the pressure caused by the head of water.

It is always a good plan with any kind of hot water system to have a thermometer on the boiler, but it is especially advisable with a generator. It will show you at a glance the temperature of the water in the boiler and in time you will come to know how much heat to carry to get the required temperature in the greenhouse. This thermometer will also show whether temperatures carried are too high or whether you have plenty of capacity and can heat easily with a low water temperature.

Chimney Flues

No boiler can work properly unless it is attached to a chimney of the proper size, construction and height.

The best chimney is a round one and next in order of efficiency comes the square flue. A chimney of oblong form is the least effective of all. A round flue presents less friction surface to the smoke and escaping gases than any other style in proportion to its capacity. The corners in a square chimney are practically of no value and, therefore, the square chimney must have sides equal to the diameter of a round one to give the same results.

The list size of smoke pipe opening as given in the catalogue should not in any manner govern the area of the flue to which the boiler is to be attached.

Boiler should sit as near as possible to the cihmney and a damper should always be used in the smoke pipe connecting boiler to the chimney. No boiler will give the best results if improperly connected to chimney or chimney flue.

The chimney should be perfectly straight, smoothly plastered inside or tile lined without any openings other than for the boiler. It should extend above the highest point of adjacent buildings or surrounding objects. Most heating troubles are directly due to defective chimneys so make sure of your flue before putting in the boiler. The most common defect is lack of capacity but it is just as bad to have the chimney too large. You must have proper volume of air in the chimney, as every pound of coal requires a certain amount of air to burn it and it is absolutely necessary to have sufficient area in the flue to permit the passage of enough air through the boiler to properly burn the coal. Velocity cannot make up for volume. By velocity we mean the speed the air travels through the chimney and by volume we mean the quantity of air. You must have both velocity and volume to get perfect results.

A newly built chimney will not draw perfectly and due allowance should be made until it is thoroughly dried out. About one or two week's time will be required. The best chimney is a brick one but where first cost is an item it is a good plan to buy a steel stack.

When connecting boiler be sure smoke pipe does not extend too far into the chimney and thus lessen the area at this important point where the smoke leaves the pipe and enters the flue. Be sure chimney is provided with a soot pocket with suitable clean-out door.

The table on next page gives the diameter and height of the flue required for the efficient and economical operation of our boilers.

The figures in the columns represent the inside diameter for a round flue and square chimneys with sides equal to the diameter given will be considered equivalent. Rectangular chimneys should have a larger area.

Chimney Sizes

No.	Rating Water	Rating Steam	Height of Chimney in Feet 30	40	50	60	80
418	650	400	12	12	11	..	..
518	910	550	12	12	11	..	..
618	1170	700	12	12	12	..	..
718	1430	850	12	12	12	..	..
522	1320	800	15	15	14	..	..
622	1650	1000	15	15	14	..	..
722	1980	1200	15	15	14	..	..
822	2310	1400	15	15	14	..	..
627	2230	1350	17	16	16	..	..
727	2720	1650	17	17	16	..	..
827	3210	1950	17	17	16	..	..
927	3700	2250	17	17	16	..	..
235	3150	1900	16	16	15	..	..
236	3900	2350	16	16	15	15	..
237	4650	2800	17	17	16	15	15
238	5450	3250	17	17	17	16	15
239	6150	3700	18	18	18	17	16
240	6900	4150	18	18	18	17	16
276	6675	4100	21	21	21	20	20
277	8175	4950	22	22	22	21	21
278	9547	5800	23	23	23	22	22
279	10975	6650	23	23	23	22	22
280	12375	7500	24	24	24	23	23
281	13775	8350	24	24	24	23	23

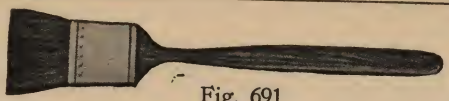
Steel Chimneys

The following list shows standard gauges, sizes and lengths of steel chimneys. These chimneys will be furnished with square hood at the lower end to fit over brick foundation. In ordering please give size of brick foundation outside and inside. Extra charges are made for hood at upper end and special prices will be quoted on other gauges, sizes and lengths.

Size Diameter	Gauge Metal	List Price 30 Feet	List Price 40 Feet
7″	16	$28.44	$36.04
8″	16	28.72	36.32
9″	16	29.60	37.48
10″	16	33.64	43.60
12″	16	36.82	46.62
14″	16	40.66	51.50
16″	16	48.30	61.30
18″	14	56.04	70.96
20″	14	59.20	74.96
22″	14	62.26	78.86
24″	14	65.30	82.70

Prices subject to discount.

Brushes



Bronzing

Fig. 691

Capitol Bronzing Brushes have extra long handles, making them most practical for easily bronzing radiators. The bristles are of fine quality, especially suited for high grade work.

1-inch, each.....$0.40 2-inch, each.....$0.60
1½-inch, each..... .50 2½-inch, each..... .70

Radiator

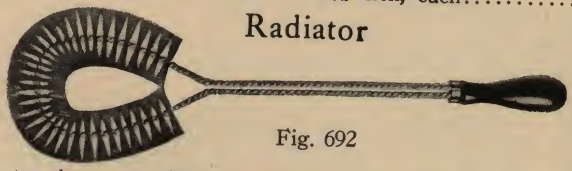


Fig. 692

This cut illustrates the most advanced radiator brush made. It has no wooden parts to break, the bristles are held securely and it is otherwise very durable. The shape and size make it possible to remove any accumulation of dust from the interior surface of the radiator with one motion of the brush. Also handy for cleaning between spindles of stairway, under heavy furniture or in out of the way corners.

Capitol Radiator Brushes.....list each, $0.80

Flue

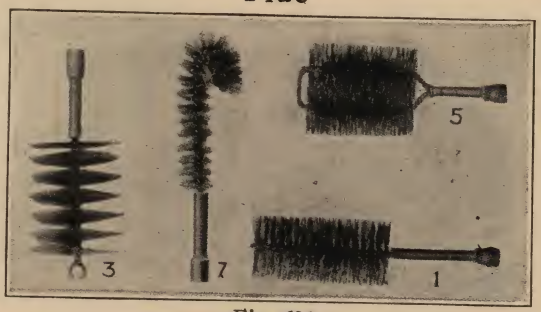


Fig. 693

No.	Description	Price List
1.	Round wire, 3 inches diameter	$1.00
2.	Round wire, 3 inches diameter, same as No. 1, except with 55-inch flexible wire handle	1.20
3.	Flat tempered wire, 2x3¼-inch, oval sides	1.30.
4.	Flat tempered wire, 3x4-inch, oval sides	1.40
5.	Double brush, 1¾x4½x4 inches	1.50
6.	Double Brush, 2½x6x4 inches	2.00
7.	Round end, fine wire, 1½ inches diameter	1.00
8.	Round end, fine wire, 1½ inches diameter	1.00

Engineers Favorite Flue Cleaner

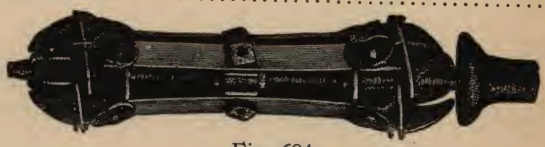
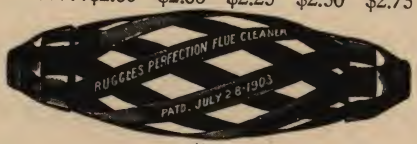


Fig. 694

Size, Inches..	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5	6
Each	$2.00	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$4.00	$4.50	$6.25	$7.50



Perfection Flue Cleaners

Fig. 695

Size, Inches.....	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5
Each	$2.00	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$4.00	$5.00	$6.00

Thermometers and Altitude Gauges

Fig. 696
No. 10 Straight

ALTITUDE GAUGE

Fig. 697
No. 20 Angle

The thermometer is a necessary adjunct to a hot water heating plant. Will record temperatures accurately and quickly. Care should be taken to be sure that the metal tube surrounding the glass bulb is thoroughly immersed in the hot water.

No. 10. Straight .....price each $1.70
No. 20. Angle .....price each 2.00

The gauge indicates at the boiler the height of water in the system. Fitted with red adjustable hand, to be set at height desired by the user. The black operating hand indicates the actual height of water and therefore shows any variations in the water level.

To set: Fill the system to its proper level, move red hand to the height indicated by the operating hand. Water should be added as soon as the water falls below the height indicated by the red hand. Ring that holds glass is secured by cotter pins to permit of easy removal for setting.

Price each, with cock.....$3.00

Taylor Syphon Heat Circulator

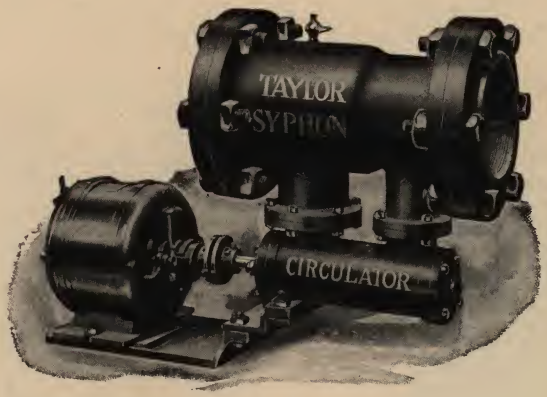


Fig. 698

Patents Pending

This little machine connected to any hot water heating system will circulate the water throughout the houses at any temperature of the water in the boiler. This causes the water to pass over the heated boiler surfaces more often and saves on fuel.

All valves have been eliminated and circulation is never impeded. It helps a good system and cures a bad one.

Size in Inches	List Price with Motor
2 or 2½	$ 65.00
3	75.00
3½	85.00
4	100.00
4½	120.00
5	140.00
6	180.00
7	225.00
8	300.00

EXPANSION TANKS

Galvanized Steel.

Double riveted and tested at high pressure before shipment.

Guaranteed in every respect.

Tappings: These tanks are tapped top and bottom with one inch openings, and one inch on side for water supply; — half inch openings for water gauge.

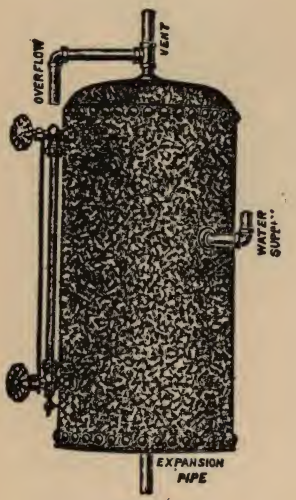


Fig. 184

Price List

Capacity Gallons	Size	For use with Sq. Ft. of Radiation	List Price
6	9x20	200	$6.00
10	12x20	300	8.00
12	12x24	400	8.50
15	12x30	500	9.00
18	12x36	600	9.50
20	14x30	700	12.50
24	14x36	850	13.00
26	16x30	950	14.00
32	16x36	1300	15.00
42	16x48	2000	16.50
66	18x60	3000	31.00
82	20x60	5000	37.00
100	22x60	6000	51.00
120	24x60	7000	58.00

Prices do not include Water Gauges or Trimmings.

List Price on Water Gauges, $2.50.

Filling Attachment, $1.50 net, additional.

AUTOMATIC EXPANSION TANK

The Expansion Tank below illustrated, aside from being ornamental, is absolutely automatic in its operation, **insuring always that the system will be full of water.** It is a great convenience to the house-owner. There is danger of freezing if the ordinary non-automatic tank is placed in the attic or some out-of-the-way closet. Besides, the customer is often opposed to having an ungainly steel or iron Expansion Tank placed in the bath room or in a living room. The Tank is made of hardwood, lined with sheet copper, and is finished and varnished to match the woodwork of the room. It does not require altitude gauge nor gauge glass and fittings.

In side measurements of Tank are: 20 inches long, 9 inches wide, 10 in. deep; and of ample capacity for use on any job of hot water work to which there is attached 2500 feet of radiation or less.

Price List for Tanks.

Including expansion and overflow couplings ,with iron pipe threads.

Style	Description	List
282	Plain, without varnish, plain oak	$7.00
252	Square corners, varnished plain oak	8.50
262	Rounded corners, varnished plain oak	9.00

Order by number and specify finish desired.

Hot Water Thermometers, each, $4.00
Altitude gauges, each 8.00

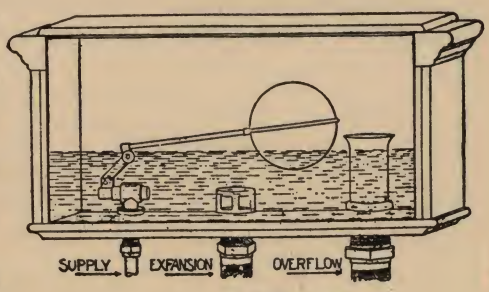


Fig. 185

FLOOR AND CEILING PLATES

B AND C.

Fig. 699

Ceiling

B and C adjustable hinged plates are constructed so that the ceiling plate is held in place by means of a screw; the floor plate simply snapped around pipe Copper-plated before nickeling. Specify whether floor or ceiling plates are wanted.

For pipe, inches	*⅜	½	¾	1	1¼	1½	2	2½	3	3½	4
Nickeled, each	$0 25	$0 25	$0 25	$0 28	$0 32	$0 35	$0 38	$0 52	$0 75	$1 10	$1.50
Black, each	.14	14	14	18	20	24	28	43	60	90	1.25

* ⅜-inch plate can only be furnished in floor pattern.

SNAPLOCK

Fig. 700

Floor or Ceiling

Snaplock floor and ceiling plates are made of but two pieces of cold rolled steel, riveted together Nothing to get out of order or lost Better than any one-piece stamped plate because of their strength and the fact they can be applied after balance of work is completed. Finished same as higher priced plates.

For pipe, inches	½	¾	1	1¼	1½	2
Nickeled, each	$0 25	$0 25	$0 28	$0.32	$0.35	$0.38
Black, each	14	14	.18	.20	.24	.28

MINNEAPOLIS HEAT REGULATORS

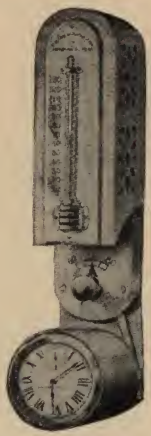


Fig. 701

Thermostat with Time Attachment

Fig. 702

Thermostat with Screen Removed

THE regulator complete consists of the thermostat and a motor operated by battery cells. When circular metal blade expands or contracts through change of temperature, the bottom end touches either post, and the connection formed allows the electric current to start the motor. The brake is thus released and the driving shaft of the motor makes a half revolution, opening or closing the dampers.

The time attachment consists of a clock securely held by spring clamps to the Thermostat. The clock swings on a pivot and may be wound and alarm set without detaching. Needs rewinding but once in every eight days, which insures the regular morning change of temperature even should the alarm be forgotten for a week. If it is desired to keep the building at a lower temperature during the night than that maintained during the day, it can be done as follows: Shift pointer to temperature desired for night and set alarm for the time that day temperature is desired to commence. The dampers are regulated at that temperature until time set for day temperature, when pointer is automatically moved to 70 degrees. During the day the pointer can be set at any temperature desired. The range of temperature is fixed by adjusting the set screws at each side of temperature blade. A travel of two degrees is found to give the best results for ordinary use.

Price for regulator complete with time attachment . $47.00
Price for regulator without time attachment 40.00

Can be easily applied to any style of heating apparatus, old or new. Complete descriptive circular on application.

Bronze and Liquid.

We have devoted considerable study to the question of offering the trade a line of Radiator Bronzes that would recommend itself after it had once been used. Our strongest effort has been to furnish the best values, considering carefully the rich and brilliant finish, amount of covering capacity and lasting qualities.

Directions for Use.

BRONZES—Use a bronze primer, or if you want to finish a job quickly, give the radiator first a coat of bronzing liquid; this will dry in about twenty minutes with gloss covering up all the dirt and rust. Then mix the bronze powder with the bronzing liquid to the consistency of cream and apply evenly, that is, in one direction only. Always use a soft brush, as a stiff brush cuts the bronze, ruining the high finish. If bronze is applied when radiator is warm, the lustre is improved.

One pound of gold or color bronze requires one quart of liquid and will cover from 250 to 300 square feet of radiation.

One pound of aluminum bronze requires about one gallon of liquid and will cover from 500 to 600 square feet of radiation.

BRONZE POWDERS.

	List, Each
Pale Gold, one-pound cans	$0.90
Rich Gold, one-pound cans	.90
Pure Metal Leaf, one-pound cans	1.25
(Pure Metal Leaf Bronze is the highest grade of pale gold, unrivalled in brilliancy and permanency of tone and color.)	
Aluminum, one-pound cans	$1.50
Aluminum, half-pound cans	.90
Aluminum, quarter-pound cans	.50
(Aluminum Bronze guaranteed chemically pure.)	
Green, one-pound cans	$1.25
Maroon, one-pound cans	1.50
Chocolate, one-pound cans	1.50
Copper, one-pound cans	1.25
Fire, one-pound cans	1.25

BRONZE LIQUID.

	List, Each
One-gallon cans, per gallon	$1.50
One-half-gallon cans, per gallon	2.00

How to Figure Amount of Pipe Required

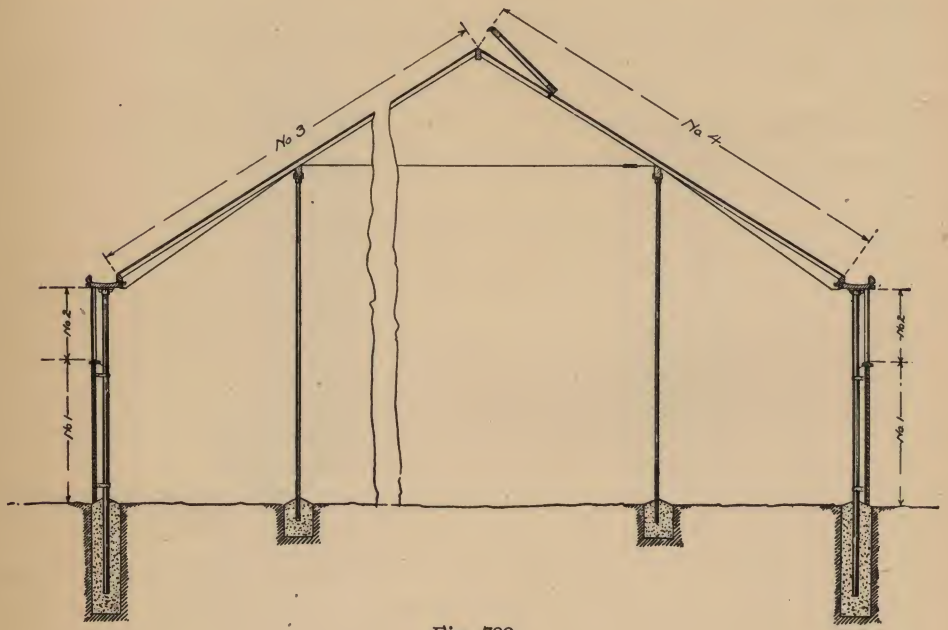


Fig. 799

In order to find the correct number of flows and returns for a greenhouse it will be necessary to reduce all surface to the equivalent of glass surface. For walls made with sheathing divide the number of feet of sheathing by 3, and for cement walls divide the number of feet of cement by 4.

You will notice on the above diagram we show a house with glass below the gutters and sheathing below the glass. We will assume that this house is 28 ft. wide and 100 ft. long. The distance indicated by No. 1 is 4 ft. 6 in. on each side or a total of 9 ft. and to reduce this to glass surface this must be divided by 3, which gives us a total of 3 ft. of glass surface. No. 2 on each side is 2 ft. making a total of 4 ft. of glass surface, which added to the 3 ft. figured for sheathing makes a total of 7 ft. for the walls. No. 3 and No. 4 are each 16 ft. making a total on the roof of 32 ft. which added to the total of 7 ft. for the walls gives 39 sq. ft. of glass surface per lin. ft. of house.

You now add ¼ of the width of the house to the length and multiply this by the number of sq. ft. of glass per lin. ft. As this house is 100 ft. long and 28 ft. wide you will need to figure the length as 107 ft. and this multiplied by 39 gives you a total of 4,173 sq. ft. of glass surface. Do not figure gable ends.

How to Figure Amount of Pipe Required.

(Continued)

You will notice on following pages that each sq. ft. of glass for 60 degrees, for steam heat, requires .17 sq. ft. of radiation. If you will multiply the number of sq. ft. by .17 you will get a total of 709 sq. ft. of radiation.

You will notice further that is is necessary to put in a 3-inch flow to supply 670 sq. ft. of radiation by referring to the tables on following pages for flows and mains. This is the nearest amount of radiation as a 3½-inch pipe will supply 920 sq. ft. (Where the amount required is very little more than the amount specified for a given size of pipe use the size below it.) A 3-inch pipe 100 ft. long, which is the length of this house, will supply 90 sq. ft. of radiation (refer to tables) and this amount should be deducted from the total of 709 sq. ft.

This leaves 619 sq. ft. of radiation to be supplied by the returns. Reference to table shows 1-inch or 1¼-inch pipe is generally used for returns for a house of this length. If you want to use 1¼-inch pipe you will find in the table that each 100 ft. supplies 43 sq. ft. of radiation. If you will divide 619 by 43 you will find 14 1¼-inch returns will be required to give temperature of 60 degrees.

If 1-inch pipe is to be used you will find by referring to table each 100 ft. supplies 34½ sq. ft. Divide 619 by this amount and you will find 18 lines of 1-inch pipe will be needed to supply the necessary heat.

For figuring mains refer to the tables.

For the above house a 3-inch main will be necessary, but if two houses are built making a total of 1,418 sq. ft. of radiation a 4½-inch main would be needed as a main of this size will supply 1,650 sq. ft. and the 3-inch flow in each house can then be connected to the main supply.

When writing for estimates on heating always give us measurements indicated by numbers on diagram.

Table for Figuring Heating

Radiation required for each square foot of glass exposure and equivalent for various temperatures at zero and 10 degrees below zero.

Steam								Water							
40°	45°	50°	55°	60°	65°	70°	75°	40°	45°	50°	55°	60°	65°	70°	75°
.12	.134	.15	.16	.17	.185	.20	.215	.20	.223	.25	.266	.286	.309	.333	.358

NOTE. For each degree below 10° below zero add 2% and for each degree above zero deduct 2%.

Sizes of Pipe for Returns generally used for Various Lengths of Houses

Steam (Low Pressure)						Water					
50 Feet	100 Feet	150 Feet	200 Feet	250 Feet	500 Feet	50 Feet	100 Feet	150 Feet	200 Feet	250 Feet	500 Feet
1"	1" 1¼"	1¼"	1¼" 1½"	1¼" 1½"	2"	1¼" 1½"	1½" 2"	2"	2"	2"	2" 2½"

Sizes of Pipe for Flows and Mains for a Given Amount of Radiation

Steam (Low Pressure)			Water	
Size of Flow	Square Feet of Radiation	Size of Return	Square Feet of Radiation	Size of Pipe
1¼"	80	¾"	90	1¼"
1½"	140	1"	130	1½"
2"	300	1"	250	2"
2½"	460	1¼"	350	2½"
3"	670	1¼"	500	3"
3½"	920	1½"	700	3½"
4"	1200	1½"	900	4"
4½"	1550	1½"	1150	4½"
5"	1875	2"	1400	5"
6"	2700	2"	2100	6"
7"	3700	2½"	3000	7"

Table of Radiation for Glass

Steam.

Table of Amounts of Steam Radiating Surface Necessary to Heat a Given Amount of Glass Exposure to Various Temperatures in Zero Weather.

Sqnare Feet of Exposure	Number of Square Feet of Radiation Required at				
	40°	45°	50°	60°	70°
25	2 7/9	3 1/8	3 4/7	4 1/6	5
50	5 5/9	6 1/4	7 1/7	8 1/3	10
75	8	9	10	13	15
100	11	13	14	17	20
200	23	25	30	33	40
300	34	38	43	50	60
400	45	50	57	67	80
500	56	63	72	83	100
1000	112	125	143	167	200
2000	223	250	286	333	400
3000	334	375	429	500	600
4000	445	500	571	667	800
5000	556	625	714	833	1000
10000	1112	1250	1429	1667	2000
20000	2223	2500	2857	3333	4000
30000	3334	3750	4286	5000	6000
40000	4445	5000	5714	6667	8000
50000	5556	6250	7143	8333	10000

Hot Water.

Table of Amount of Hot-Water Radiating Surface Necessary to Heat a Given Amount of Glass Exposure to Various Temperatures in Zero Weather.

Square Feet of Exposure	Number of Square Feet of Radiation Required at				
	40°	45°	50°	60°	70°
25	4 1/8	5	6 1/4	7 1/7	8 1/3
50	8	10	13	14	16
75	13	15	19	21	25
100	17	20	25	29	33
200	33	40	50	57	67
300	50	60	75	86	100
400	67	80	100	114	133
500	83	100	125	143	167
1000	167	200	250	286	333
2000	333	400	500	572	667
3000	500	600	750	857	1000
4000	667	800	1000	1143	1333
5000	833	1000	1250	1429	1667
10000	1667	2000	2500	2857	3333
20000	3333	4000	5000	5714	6667
30000	5000	6000	7500	8573	10000
40000	6667	8000	10000	11429	13333
50000	8333	10000	12500	142S6	16667

To figure amount of glass surface and equivalent see diagram and explanation on page 19.

How to Figure Amount of Pipe Required.

(Continued)

SQUARE FEET OF RADIATING SURFACE OF PIPE PER LINEAL FOOT

On all lengths over one foot, fractions less than tenths are added to or dropped.

Length of Pipe	Size of Pipe									
	¾	1	1¼	1½	2	2½	3	4	5	6
1	.275	.346	.434	.494	.622	.753	.916	1.175	1.455	1.739
2	.5	.7	.9	1.	1.2	1.5	1.8	2.4	2.9	3.5
3	.8	1.	1.3	1.5	1.9	2.3	2.7	3.5	4.4	5.2
4	1.1	1.4	1.7	2.	2.5	3.	3.6	4.7	5.8	7.
5	1.4	1.7	2.2	2.4	3.1	3.8	4.6	5.8	7.3	7.7
6	1.6	2.1	2.6	2.9	3.7	4.5	5.5	7.	8.7	10.5
7	1.9	2.4	3.	3.4	4.4	5.3	6.4	8.2	10.2	12.1
8	2.2	2.8	3.5	3.9	5.	6.	7.3	9.4	11.6	13.9
9	2.5	3.1	3.9	4.4	5.6	6.8	8.2	10.6	13.1	15.7
10	2.7	3.5	4.3	4.9	6.2	7.5	9.1	11.8	14.6	17.4
11	3.	3.8	4.8	5.4	6.8	8.3	10.	12.9	16.	19.1
12	3.3	4.1	5.2	5.9	7.5	9.	11.	14.1	17.4	20.9
13	3.6	4.5	5.6	6.4	8.1	9.8	11.9	15.3	18.9	22.6
14	3.8	4.8	6.1	6.9	8.7	10.5	12.8	16.5	20.3	24.3
15	4.1	5.2	6.5	7.4	9.3	11.3	13.7	17.6	21.8	26.1
16	4.4	5.5	6.9	7.9	10.	12.	14.6	18.8	23.2	27.8
17	4.7	5.9	7.4	8.4	10.6	12.3	15.5	20.	24.7	29.5
18	5.	6.2	7.8	8.9	11.2	13.5	16.5	21.2	26.2	31.3
19	5.2	6.6	8.3	9.4	11.8	14.3	17.4	22.3	27.6	33.1
20	5.5	6.9	8.7	9.9	12.5	15.	18.3	23.5	29.1	34.8
21	5.8	7.3	9.1	10.4	13.	15.8	19.2	24.7	30.5	36.5
22	6.	7.6	9.6	10.9	13.7	16.5	20.2	25.9	32.	38.3
23	6.3	8.	10.	11.3	14.3	17.3	21.1	27.	33.5	40.
24	6.6	8.3	10.4	11.9	14.9	18.	22.	28.2	34.9	41.7
25	6.9	8.6	10.9	12.3	15.6	18.8	22.9	29.3	36.4	43.5
26	7.1	9.	11.3	12.8	16.2	19.5	23.8	30.5	37.8	45.2
27	7.4	9.4	11.7	13.3	16.8	20.3	24.7	31.7	39.3	47.
28	7.7	9.7	12.2	13.8	17.4	21.	25.6	32.9	40.7	48.7
29	8.	10.	12.6	14.3	18.	21.8	26.6	34.1	42.2	50.4
30	8.3	10.4	13.	14.8	18.7	22.5	27.5	35.3	43.6	52.1
31	8.5	10.7	13.5	15.3	19.3	23.3	28.4	36.4	45.1	53.9
32	8.8	11.1	13.9	15.8	19.9	24.1	29.3	37.6	46.5	55.6
33	9.1	11.4	14.3	16.3	20.5	24.8	30.2	38.8	48.	57.4
34	9.4	11.7	14.7	16.8	21.2	25.6	31.1	40.	49.5	59.1
35	9.6	12.1	15.2	17.3	21.8	26.3	32.	41.1	50.9	60.8
36	9.9	12.5	15.6	17.8	22.4	27.	33.	42.3	52.4	62.6
37	10.2	12.8	16.1	18.3	23.	27.8	33.9	43.5	53.8	64.3
38	10.5	13.2	16.5	18.8	23.7	28.5	34.8	44.6	55.2	66.
39	10.7	13.5	16.9	19.3	24.3	29.3	35.7	45.8	56.7	67.8
40	11.	13.8	17.4	19.8	24.9	30.1	36.6	47.	58.2	69.5
41	11.3	14.2	17.8	20.3	25.5	30.8	37.6	48.2	59.6	71.3
42	11.5	14.5	18.2	20.8	26.1	31.6	38.5	49.4	61.1	73.
43	11.8	14.9	18.7	21.3	26.8	32.3	39.4	50.6	62.5	74.8
44	12.1	15.2	19.1	21.8	27.4	33.1	40.3	51.7	64.	76.5
45	12.4	15.6	19.5	22.2	28.	33.8	41.2	52.9	65.5	78.2
46	12.7	15.9	20.	22.7	28.6	34.6	42.2	54.	67.	80.
47	12.9	16.3	20.4	23.2	29.2	35.3	43.	55.2	68.4	81.7
48	13.2	16.6	20.8	23.7	29.9	36.1	43.9	56.4	69.8	83.5
49	13.5	17.	21.3	24.2	30.5	36.8	44.8	57.6	71.2	85.1
50	13.8	17.3	21.7	24.7	31.1	37.6	45.8	58.7	72.7	87.

NOTE—Above information is quoted from standard authorities. Not guaranteed.

INFORMATION ABOUT PIPE

How to Figure Amount of Pipe Required.

(Continued)

Size	Length of Pipe per Sq. Ft. of Radiation	Sq. Ft. of Radiation per Lineal Ft. of Pipe	External Diameter Inches	Internal Diameter Inches	Internal Area Square Inch	Size Hole to drill for Tap Inches	Number of Threads per Inch Standard	Nominal Weight per foot	Price per Foot
½	4.547	.220	.840	.623	.3048	21/32	14	.837	.8½
¾	3.637	.275	1.050	.824	.5333	11/16	14	1.115	.11½
1	2.904	.346	1.315	1.048	.8626	1 3/16	11½	1.668	.17
1¼	2.301	.434	1.660	1.380	1.496	1 1/2	11½	2.244	.23
1½	2.01	.494	1.900	1.611	2.038	1 23/32	11½	2.678	.27½
2	1.68	.622	2.375	2.067	3.356	2 3/16	11½	3.609	.37
2½	1.328	.753	2.875	2.468	4.784	2 5/8	8	5.739	.58½
3	1.091	.916	3.500	3.067	7.388	3¼	8	7.536	.76½
3½	.955	1.055	4.000	3.548	9.887	3¾	8	9.001	.92
4	.849	1.175	4.500	4.026	12.73	4¼	8	10.665	1.09
4½	.764	1.309	5.000	4.508	15.961	4¾	8	12.34	1.27
5	.678	1.455	5.563	5.045	19.96	5 3/16	8	14.502	1.48
6	.577	1.739	6.625	6.065	28.888	6 3/16	8	18.762	1.92
7	.501	1.996	7.625	7.023	38.738	7⅛	8	23.271	2.38
8	.443	2.257	8.625	7.083	50.04	8⅛	8	28.177	2.88

About Heating Your Residence.

We can furnish all materials for this work including boilers, radiators, valves, pipe, fittings, bronzes, etc.

It is general practice to consider 70 degrees as the standard for inside temperature and zero for the outside, but when there is a greater difference between the inside and the outside temperature, one per cent should be added to the radiation for each degree of difference.

Many people make the mistake of installing a too small amount of radiation in work of this kind and we caution you to be sure and put in enough. Nearly all rules are based on two to five pounds steam pressure for steam heating and a temperature of 180 degrees for water as indicated by the boiler when the outside temperature is zero.

When systems are designed for heating with a lower temperature at the boiler, additional radiation must be installed.

It is necessary when figuring work of this kind to take into consideration all the conditions or deductions according to the requirements, no matter what rule you use for estimating.

The following rules have been in general use for some time but are not guaranteed. By using these rules and providing for additional radiation on the cold sides of building and making allowance for poor construction, loose fitting of windows, doors, etc., good results will undoubtedly be obtained.

Rule No. 1.

This is termed "Rule of Thumb."

As this method of figuring only considers the cubical contents of space to be heated, some experience in heating is required to determine the proper factor to be used for different conditions. The exposed wall and glass surface varies the amount of radiation to be used.

One Square Foot of Direct Radiation Will Heat.

	Cubic Feet by Hot Water	Cubic Feet by Steam
DWELLINGS		
Living Rooms, one side exposed	25 to 30	45 to 50
Living Rooms, two sides exposed	20 to 30	40 to 50
Living Rooms, three sides exposed	20 to 25	35 to 45
Sleeping Rooms	30 to 40	50 to 60
Halls and Bath Rooms	20 to 30	40 to 50
PUBLIC BUILDINGS		
Offices	30 to 50	50 to 75
School Rooms	20 to 30	55 to 80
Factories and Stores	40 to 60	80 to 100
Assembly Halls and Churches	60 to 80	100 to 125

About Heating Your Residence.

Rule No. 2.

Known as "Mills' Rule."

One square foot of radiating surface for each 2 square feet of glass, and for each 20 square feet exposed outside wall and each 200 cubic feet of space.

Example: A given room has 60 square feet of glass, 220 square feet of exposed wall and 2,000 cubic feet of air. (Room is on first floor.)

Glass 60÷ 2	÷30 square feet of radiation
Wall 220÷20	=11 square feet of radiation
Cubical contents 2,000÷200	=10 square feet of radiation
Total	51 square feet of radiation

Above figures are for steam. For water (in accordance with accepted standards) add 65 per cent. This would add for the above 33 square feet and make a total of 84 square feet.

Rule No. 3.

Professor R. C. Carpenter, of Cornell University, submits the following rule for determining the size of radiator for a given room:

Rule: Add the area of the glass surface in the room to one-quarter of the exposed wall surface, and to this add from 1-55 to 3-55 of the cubical contents (1-55 for rooms on upper floor, 2-55 for rooms on first floor and 3-55 for large halls); then for steam multiply by .25 and for hot water by .40.

Example: A room 20x12x10 feet with glass exposure of 48 feet, one-quarter of wall exposure (two sides exposed) 320 feet = 80, 1-55 of cubical contents 2,400=44.

48+80+44=172×.25=43 feet for steam.
If you add 2-55 the surface would be 54 feet.
If you add 3-55 the surface would be 65 feet.

How to Cover your Boiler with Asbestos

The use of Asbestos cement on your boiler will save several dollars each winter in fuel for it helps the boiler to retain all of the heat units and they are utilized in the greenhouse in place of being wasted in the boiler room. As a general rule it is not necessary to keep the boiler room very warm and the front of the boiler will radiate enough heat to give temperature for firing, etc.

It is also a good plan to cover the pipe over the boiler and all other pipe not needed for heating. On steam mains it is almost a necessity and on hot water mains there is a great deal of saving. Not only should the flow pipe be covered but the return pipe as well.

Pipe that is buried in the ground loses a large amount of heat as the earth is an excellent conductor. The warmer the water when it returns to the boiler the less fuel required to reheat it, so be sure and cover your return mains if they are not needed for heating. The warm water as it goes out in the flow will do more and better work if the pipe is covered, for your coils get it at practically the same temperature it leaves the boiler.

The cost of covering boilers with this cement is low. Compared to the amount of heating you can save by the use of this cement and pipe covering, the cost is practically nothing.

Referring to table of sizes you will find column showing amount of Asbestos cement required to cover the various sizes of boilers.

Asbestos should be applied as follows: Mix with water to the consistency of thin mortar enough asbestos for the first coat, and let it stand about twenty-four hours before using; this coat, which should be one-half of the entire thickness of the covering should be thrown on the surface in handfuls, using just enough force to make it stick, but not to pack it solidly. The more loosely it is applied, the more effective.

Boiler should be warmed a little before applying the cement as it will stick and dry better than if surface is cold. When the first coat is thoroughly dry apply the second, which should be of thicker consistency, in the same manner as the first. When the second coat is dry apply the finish coat with trowel. When nicely

leveled and smoothed, which is best done with a straight edge, a nice finish can be given.

We also recommend using a canvas jacket over the asbestos. This can be applied by using a flour paste to hold it to the asbestos, and can be painted with asphaltum to make it moisture proof.

Air Required for Combustion

The burning of a given quantity of fuel requires a definite amount of oxygen to properly consume it. The oxygen is contained in the air in sufficient quantities that three hundred (300) cubic feet of air will properly burn one pound of coal. If a less quantity of air is supplied, the combustion will not be good and a large amount of unconsumed gas will escape up the chimney with a corresponding waste of coal and a less sufficient boiler. This fact shows the importance of a good chimney flue of efficient capacity and a boiler room having an ample fresh air supply. The supply of air must enter under the grates of the boiler to support the combustion of the fuel. If a boiler is rated for 2,000 feet steam capacity there must be developed 480,000 B. T. U. per hour to maintain this maximum capacity. Assuming the coal at a value of 12,500 B. T. U. per pound, and allowing that we can transmit 70 per cent of the heat into the work, this would require 54.7 pounds of coal per hour, and with a grate containing ten square feet it would mean a combustion of 5.4 pounds of coal per square foot of grate per hour. Such a boiler will require a chimney 12 inches in diameter, if round, or 12x12 inches if built square, as the corners of a square chimney are not effective. A chimney fifty feet high should have a draft equal to one inch of water and a capacity of 42,000 cubic feet per hour, not counting the friction of traveling through the fuel, boiler and flues to the chimney. This friction takes 60 per cent of the power of the chimney, thus reducing the actual air supply of such chimney to 16,800 cubic feet per hour. The air needed to supply 54.7 pounds of coal per hour is 16,410 cubic feet. Any reduction of height or pressure must be compensated for by increased area.

EXTREME VARIATION OF TEMPERATURE IN THE UNITED STATES

States	Cities	Highest	Lowest	States	Cities	Highest	Lowest
Ala.	Mobile	101	11	Mo.	St. Louis	106	—22
	Montgomery	107	5		Springfield	99	—11
Ariz.	Grant, Fort	103	7	N. C.	Charlotte	102	— 5
	Prescott	103	—18		Hatteras	92	8
	Yuma	118	22		Wilmington	103	9
Ark.	Fort Smith	104	— 7	Neb.	North Platte	107	—35
	Little Rock	102	— 5		Omaha	105	—32
Cal.	Red Bluff	112	18		Valentine	106	—35
	Sacramento	108	19	Nev.	Winnemucca	104	—28
	San Diego	101	32	N. D.	Bismark	105	—44
Colo.	Denver	105	—29		Buford, Ft.	107	—49
	Las Animas	105	—26	N. H.	Manchester	96	—11
	Montrose	98	—20	N. J.	Atlantic City	99	— 7
Conn.	New Haven	100	—14		Cape May	91	1
	New London	93	—10		New Brunsw.	98	—12
Del.	Del Break'r	93	1	N. M.	Santa Fe	97	—13
Dist. of Col.	Washington	104	—14		Stanton, Ft.	95	—18
Fla.	Jacksonville	104	15	N. Y.	Albany	98	—18
	Key West	100	41		N. Y. City	100	— 6
	Pensacola	99	15		Oswego	100	—23
Ga.	Atlanta	100	— 2	Ohio	Cincinnati	104	—12
	Augusta	105	6		Columbus	103	—20
	Savannah	105	12		Toledo	99	—16
Idaho	Boise City	107	—28	Ore.	Portland	99	— 2
Ill.	Cairo	103	—16		Roseburg	102	— 6
	Chicago	100	—23		Umatilla	110	—24
	Springfield	102	—22	Pa.	Erie	94	—16
Ind.	Indianapolis	101	—25		Philadelphia	102	— 5
In.Tr.	Sill, Fort	107	— 9		Pittsburg	103	—12
Iowa	Des Moines	104	—30	R. I.	Block Island	88	— 4
	Dubuque	101	—32		Newport	92	— 8
	Keokuk	104	—24	S. C.	Charleston	104	10
Kan.	Dodge City	108	—20	S. D.	Yankton	103	—34
	Concordia	104	—25	Tenn.	Chattanooga	101	—7
	Leavenworth	107	—29		Memphis	102	— 8
Ky.	Louisville	105	—20		Nashville	104	—10
La.	New Orleans	97	15	Texas	Elliott, Ft.	108	—14
	Shreveport	107	1		Brownsville	102	18
Maine	Eastport	88	—21		El Paso	113	— 5
	Portland	97	—17		Palestine	102	0
Md.	Baltimore	102	— 6	Utah	Frisco	93	0
Mass.	Boston	101	—13		Salt Lake	102	—20
	Springfield	94	—14	Vt.	Burlington	96	—25
Mich.	Grand Haven	92	—24	Va.	Lynchburg	102	— 5
	Marquette	100	—27		Norfolk	102	4
	Port Huron	99	—25	Wash	Dayton	109	—26
Minn.	Duluth	99	—41		Olympia	97	— 2
	St. Paul	100	—41		Tatoosh Isl.	78	14
	St. Vincent	103	—54	W. V.	Morgantown	97	—10
Miss.	Vicksburg	101	— 3	Wis.	La Crosse	101	—43
Mon,	Assinb'd, Ft.	108	—55		Milwaukee	100	—25
	Custer, Ft.	106	—48		Bridger, Ft.	89	—42
	Poplar River	110	—63	Wyo.	Cheyenne	100	—38
					Wash'kie Ft.	100	—54

The minus sign (—) indicates temperature below zero.

HEAT VALUE OF VARIOUS COALS IN THE UNITED STATES

FROM LATEST GOVERNMENT AND OTHER REPORTS.

State	Location or Name of Mine	Kind of Coal	Value in B. T. U. per lb.
Alabama	Bibb County	Bituminous	12,232 to 14,537
Alabama	Jefferson County	Bituminous	13,383 to 14,353
Alabama	Pratt City	Bituminous	13,900 to 14,500
Arkansas	Huntington County	Bituminous	12,100 to 12,550
Arkansas	Coal Hill	Bituminous	11,600 to 11,820
Colorado	Las Aruruas County	Bituminous	12,300 to 12,600
Colorado	Trinidad District	Bituminous	12,450 to 13,100
Colorado	Routt County	Bituminous	12,300 to 12,900
Illinois	Vermillion County	Bituminous	11,321 to 11,440
Illinois	Peoria County	Bituminous	10,890 to 13,373
Illinois	Staunton County	Bituminous	12,152 to 12,546
Illinois	Williamson County	Bituminous	11,622 to 12,110
Illinois	Franklin County	Bituminous	12,250 to 12,791
Illinois	St. Clair County	Bituminous	10,950 to 11,085
Illinois	Contine	Bituminous	10,000 to 11,000
Illinois	Mount Olive	Bituminous	11,200 to 11,800
Illinois	Christopher	Bituminous	11,100 to 11,500
Indiana	Block	Bituminous	10,200 to 10,450
Iowa	Milwaukee Pea	Bituminous	10,000 to 10,300
Iowa	What Cheer	Bituminous	8,000 to 8,400
Kansas	Cherokee County	Bituminous	12,132 to 13,966
Kansas	Englevale	Bituminous	11,026 to 12,547
Kansas	Crawford County	Bituminous	12,900 to 13,100
Kentucky	Hopkins County	Bituminous	11,500 to 12,000
Kentucky	Bell County	Bituminous	12,500 to 13,050
Kentucky	Hiller	Bituminous	13,500 to 14,000
Maryland	Barrellville	Bituminous	14,100 to 14,400
Maryland	George's Creek	Bituminous	13,911 to 14,397
Maryland	Garrett County	Bituminous	13,800 to 14,000
Missouri	Bevier	Bituminous	9,800 to 10,000
Missouri	Elston	Bituminous	12,500 to 12,700
New Mexico		Bituminous	11,500 to 11,800
Ohio	Hocking Valley	Bituminous	13,000 to 13,300
Ohio	Jackson County	Bituminous	11,500 to 11,800
Oklahoma	Cool	Bituminous	11,000 to 11,200
Pennsylvania	Wyoming District	Anthracite	11,560 to 12,000
Pennsylvania	Schuylkill Region	Anthracite	10,642 to 12,180
Pennsylvania	Plymouth Mine	Anthracite	13,071 to 13,581
Pennsylvania	Pittston	Anthracite	11,215 to 12,336
Pennsylvania	Scranton	Anthracite	10,500 to 12,000
Pennsylvania	Mid Valley	Anthracite	12,228 to 12,995
Pennsylvania	Kingston	Anthracite	13,449 to 14,000
Pennsylvania	Lehigh District	Anthracite	12,500 to 13,100
Pennsylvania	Allegheny County	Bituminous	12,827 to 13,824
Pennsylvania	Cambria County	Bituminous	14,435 to 14,936
Pennsylvania	Punxsutawney	Bituminous	14,301 to 14,755
Pennsylvania	Youghiogheny	Bituminous	12,379 to 13,778
Pennsylvania	Somerset County	Bituminous	14,478 to 14,853
Pennsylvania	Clearfield County	Bituminous	14,247 to 14,597
Pennsylvania	West Newton	Bituminous	12,196 to 12,400
Tennessee	Campbell County	Bituminous	13,950 to 14,500
Texas	Fort Worth	Bituminous	9,450 to 11,800
Virginia	Tazewell County Pocahontas	Bituminous	14,460 to 14,650
Washington	Carbon Hill	Bituminous	12,200 to 12,850
West Virginia	Raleigh County	Bituminous	14,665 to 15,177
West Virginia	Fayette	Bituminous	14,950 to 15,363
West Virginia	Elk Garden	Bituminous	13,900 to 14,100
West Virginia	Sharon & Smithers	Bituminous	12,800 to 14,295
West Virginia	Oregon, Cepis & Welsh	Bituminous	13,925 to 14,867
West Virginia	New River	Bituminous	14,450 to 14,700

Relative Value of Non-Conductors.

(C. E. Emery)

Non-Conductors		Non-Conductors	
Wool felts	1.000	Loam, dry and open	.550
Mineral wool, No. 2	.832	Slacked lime	.480
Mineral wool, with tar	.715	Gas-house carbon	.470
Sawdust	.680	Asbestos	.363
Mineral Wool, No. 1	.676	Coal ashes	.345
Charcoal	.632	Coke, in lumps	.277
Pine wood, across fibre	.553	Air space, undivided	.186

Values of Fuel.

Hard coal, stove or egg size, is the standard fuel on which boiler capacities are based. If other kinds are used, careful calculation is necessary to get the equivalent results. For small boilers, stove or nut coal should be used, but on the large boilers egg coal can be burned to good advantage.

Pea Coal—Experiments on power boilers have shown that 50 per cent. more power can be developed with the same grate surface when using anthracite egg coal as against anthracite pea coal (other conditions being equal). This does not mean that egg coal is more economical, but that with pea coal a larger boiler or a larger grate surface is necessary.

This is due to the fact that pea and smaller sizes of coal pack so much closer that the draft cannot get through the coal as easily, and on that account they yield up their heat more slowly. If, however, the conditions are properly considered, there is no reason why one ton of pea coal should not give up as much heat as a ton of the same grade of coal in the larger sizes, provided, of course, each lot is equally free from dirt and slate.

The draft of the chimney is the important factor in the burning of small coal. Unless the draft is very good, pea coal or smaller sizes cannot be burned successfully.

Soft coal (bituminous) requires more grate surface for the reason that it cakes together and the draft does not go through it so easily. It also requires more boiler power, for the reason that the soot cakes on the boiler surfaces and prevents (to some extent) the heat passing from fire to the water.

Soft coal varies considerably in its heat value in different parts of the country, as will be seen by the following table of heat values for various sections of the United States.

For a basis of boiler rating anthracite coal is taken as having an average value of 12,500 B. T. U. (British thermal units) per pound of coal, and the table of heat values will indicate the relative values of soft coal.

Average Weight of Coal.

One cubic foot of hard coal weighs about	50 pounds
One cubic foot of soft coal weighs about	40 pounds
One cubic foot of coke weighs about	28 pounds

HEAT UNITS IN WATER

BETWEEN 32 AND 212 DEGREES FAHRENHEIT, AND WEIGHT OF WATER PER CUBIC FOOT

Temperature Degrees F.	Heat Units	Weight in Pounds per Cubic Foot	Temperature Degrees F	Heat Units	Weight in Pounds per Cubic Foot	Temperature Degrees F.	Heat Units	Weight in Pounds per Cubic Foot
32	0.	62.42	123	91.16	61.68	168	136.44	60.81
35	3.	62.42	124	92.17	61.67	169	137.45	60.79
40	8.	62.42	125	93.17	61.65	170	138.45	60.77
45	13.	62.42	126	94.17	61.63	171	139.46	60.75
50	18.	62.41	127	95.18	61.61	172	140.47	60.73
52	20.	62.40	128	96.18	61.60	173	141.48	60.70
54	22.01	62.40	129	97.19	61.58	174	142.49	60.68
56	24.01	62.39	130	98.19	61.56	175	143.50	60.66
58	26.01	62.38	131	99.20	61.54	176	144.51	60.64
60	28.01	62.37	132	100.20	61.52	177	145.52	60.62
62	30.01	62.36	133	101.21	61.51	178	146.52	60.59
64	32.01	62.35	134	102.21	61.49	179	147.53	60.57
66	34.02	62.34	135	103.22	61.47	180	148.54	60.55
68	36.02	62.33	136	104.22	61.45	181	149.55	60.53
70	38.02	62.31	137	105.23	61.43	182	150.56	60.50
72	40.02	62.30	138	106.23	61.41	183	151.57	60.48
74	42.03	62.28	139	107.24	61.39	184	152.58	60.46
76	44.03	62.27	140	108.25	61.37	185	153.59	60.44
78	46.03	62.25	141	109.25	61.36	186	154.60	60.41
80	48.04	62.23	142	110.26	61.34	187	155.61	60.39
82	50.04	62.21	143	111.26	61.32	188	156.62	60.37
84	52.04	62.19	144	112.27	61.30	189	157.63	60.34
86	54.05	62.17	145	113.28	61.28	190	158.64	60.32
88	56.05	62.15	146	114.28	61.26	191	159.65	60.29
90	58.06	62.13	147	115.29	61.24	192	160.67	60.27
92	60.06	62.11	148	116.29	61.22	193	161.68	60.25
94	62.06	62.09	149	117.30	61.20	194	162.69	60.22
96	64.07	62.07	150	118.31	61.18	195	163.70	60.20
98	66.07	62.05	151	119.31	61.16	196	164.71	60.17
100	68.08	62.02	152	120.32	61.14	197	165.72	60.15
102	70.09	62.00	153	121.33	61.12	198	166.73	60.12
104	72.09	61.97	154	122.33	61.10	199	167.74	60.10
106	74.10	61.95	155	123.34	61.08	200	168.75	60.07
108	76.10	61.92	156	124.35	61.06	201	169.77	60.05
110	78.11	61.89	157	125.35	61.04	202	170.78	60.02
112	80.12	61.86	158	126.36	61.02	203	171.79	60.00
114	82.13	61.83	159	127.37	61.00	204	172.80	59.97
115	83.13	61.82	160	128.37	60.98	205	173.81	59.95
116	84.13	61.80	161	129.38	60.96	206	174.83	59.92
117	85.14	61.78	162	130.39	60.94	207	175.84	59.89
118	86.14	61.77	163	131.40	60.92	208	176.85	59.87
119	87.15	61.75	164	132.41	60.90	209	177.86	59.84
120	88.15	61.74	165	133.41	60.87	210	178.87	59.82
121	89.15	61.72	166	134.42	60.85	211	179.89	59.79
122	90.16	61.70	167	135.43	60.83	212	180.90	59.76

PROPERTIES OF STEAM

Pressure in Pounds Per Square Inch		Temperature in Fahrenheit Degrees	Volume		Latent Heat in Fahrenheit Degrees	Total Heat from Water at 32 Degrees in Heat Units
By Atmosphere and by Steam Gauge	Above Atmosphere		Compared with Water	Cubic Feet of Steam from 1 Pound of Water		
—12	2	137.	10730	135.	1019.	1124.
—10	4	160.	5588	78.3	1003.	1131.
— 8	6	175.	3816	55.9	992.	1135.
— 6	8	187.	2912	43.6	984.	1139.
— 4	10	197.	2361	35.8	977.	1142.
— 2	12	205.	1990	30.6	971.	1144.
0	15	212.0	1642	26.36	965.2	1146.1
5	20	228.0	1229	19.72	952.8	1150.9
10	25	240.1	996	15.99	945.3	1154.6
15	30	250.4	838	13.46	937.9	1157.8
20	35	259.3	726	11.65	931.6	1160.5
25	40	267.3	640	10.27	926.0	1162.9
30	45	274.4	572	9.18	920.9	1165.1
35	50	281.0	518	8.31	916.3	1167.1
40	55	287.1	474	7.61	912.0	1169.0
45	60	292.7	437	7.01	908.0	1170.7
50	65	298.0	405	6.49	904.2	1172.3
55	70	302.9	378	6.07	900.8	1173.8
60	75	307.5	353	5.68	897.5	1175.2
65	80	312.0	333	5.35	894.3	1176.5
70	85	316.1	314	5.05	891.4	1177.9
75	90	320.2	298	4.79	888.5	1179.1
80	95	324.1	283	4.55	885.8	1180.3
85	100	327.9	270	4.33	883.1	1181.4
90	105	331.3	257	4.14	880.7	1182.4
95	110	334.6	247	3.97	878.3	1183.5
100	115	338.0	237	3.80	875.9	1184.5
110	125	344.2	219	3.51	871.5	1186.4
120	135	350.1	203	3.27	867.4	1188.2
130	145	355.6	190	3.06	863.5	1189.9
140	155	361.0	179	2.87	859.7	1191.5
150	165	366.0	169	2.71	856.2	1192.9
160	175	370.8	159	2.56	852.9	1194.4
170	185	375.3	151	2.43	849.6	1195.8
180	195	379.7	144	2.31	846.5	1197.2

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES COMPARED WITH GLASS

Window glass	1.000
Oak and Walnut	.66
White pine	.80
Pitch pine	.100
Lath and plaster	.75 to .100
Common brick (rough)	.200 to .250
Common brick (whitewashed)	.200
Granite or slate	.250
Sheet iron	1.030 to 1.100

Hot Water and Steam

Hot Water Heating

The question of "hot water or steam" heating confronts most everybody when building a greenhouse. A great deal has been said for and against each system and it is hard to say which is the best or has been used the most. In late years, though, hot water heating has been improved wonderfully and the pressure systems installed to-day are not to be compared with the old-fashioned methods used ten and fifteen years ago. Formerly all hot water heating systems operated on the gravity principle, piping methods were crude and boilers were not as perfect as they are now, so excellent results could hardly be expected.

Strictly speaking, there are only two systems of hot water heating; the gravity system and the pressure system. With a gravity system circulation depends entirely on the force of gravity. In the pressure system circulation is forced by means of a generator or circulator. A mercury generator is the most common form of circulator for a pressure water system. Pumps and similar appliances are little used.

With the gravity system it is possible to heat houses having coils of one hundred and fifty to two hundred feet in length, but a system of this kind gives best results where coils are not over one hundred to one hundred and twenty feet. With the mercury pressure system houses can be heated up to four hundred feet in length. For a mercury system the pipe sizes are smaller than those used for gravity heating, the increased friction being overcome by the pressure. The mercury pressure system circulates four to five times as fast as the gravity system and the water passing over the heated surfaces in the boiler more often absorbs a greater amount of heat from the fire than would be utilized by a gravity system. In another part of this book you will find a full description of our mercury generator for hot water heating and we strongly recommend this system for all greenhouse plants having a glass surface less than 100,000 square feet.

Greenhouse conditions vary to such an extent that it is impossible to describe any certain method of piping. We have competent engineers in our employ who will be glad to give you information along this line if you will submit details. Generally it is best policy to have the high point on the system at or near the boiler giving the pipe a downward slope of about one inch in fifteen feet from this point to the return opening in the boiler. To get best results, boiler should set in a pit, but where this is not possible it can be set about level with the greenhouse floor. With the mercury generator a boiler set on the level will operate far better than it would with the ordinary gravity system. Overhead flows carried along the purlin supports or attached to the roof frame work, in our opinion, give the best circulation and are superior to the under bench system. If

Hot Water and Steam.

(Continued)

desired, though, all pipe can be located on the walls or under benches and overhead flows omitted. It is always good policy to give plenty of fall to the pipe whether it is a flow or return except the main flow pipe.

You will find it to your adantage to have an expert engineer design the heating system for your greenhouse. We come in contact with a large number of florists and with people experienced in heating matters and after several years in the business have gained considerable knowledge concerning heating matters, so if you place the matter in our hands we will take care of it for you in the right way. Our plans show every line of pipe, every fitting and valve, every turn, nipple and joint, proper pitch for all lines of pipe and direction of flow, also complete details of boiler connections, etc. A set of plans like this designed by an engineer who understands greenhouse heating is worth a good deal of money to you. Our price for material may not be quite as low as the bid of your local steamfitter, but everything considered, you will save money by placing your heating contract in our hands. We fully understand hot water heating and can give you an up-todate system.

Steam Heating

For large ranges and for long houses steam heating has come into general use among florists, especially in the western states. The reason for this is that steam can be circulated to better advantage than hot water and at a less cost for fuel, where the heat must travel for a long distance. As we have always said, though, hot water is the nearest thing to Sun heat and for the florist who does not employ an experienced fireman we really think the hot water system will give best results, especially where the plant is not a large one. By large plant we mean one that has 100,000 square feet of glass area or more.

There are many ways of installing a steam heating system and if you are not thoroughly acquainted with the methods in use we would suggest that you take the matter up with a competent heating engineer before you put in your system. Steam to give results must be perfectly installed. It cannot be handled in the same manner that a hot water piping system could be.

Strictly spreaking there are only two systems used to any great extent. These are low pressure steam heating and high pressure steam heating. Each system of course is varied in one place and another. The details may vary largely in one plan and another, but as stated, in general, these are the two systems used throughout the country. There are other systems of steam heating such as the vapor system, the vacuum system and one or two more, but these are used only in special instances. They are not adapted for small plants and, in fact, we think, either high pressure or low pressure is the best system that you could put in. The vacuum system requires the constant attention of a competent engineer who understands all the details of its working and if you are not thoroughly posted on vacuum heating you had better not try to operate it.

Hot Water and Steam.

(Continued)

Generally speaking the low pressure system is one that operates at a pressure of from one to ten pounds. This system operates by gravity and all of the condensation is expected to return to the boiler without the use of a pump, or a trap, or a device of any kind for lifting it. The low pressure system operating by gravity is the most economical system for steam heating that we know of. There is one disadvantage with this system. The boiler must be set in a pit and the water line in the boiler must be about two feet below the lowest return in the greenhouse under the benches. Many times it is impossible to dig a pit deep enough for steam boilers on account of the surface water and in such cases it is absolutely necessary to use more pressure on the system to get best results, and return the water of condensation from the piping system to the boiler with a steam trap or with a pump.

The high pressure system may be described as one where a pressure exceeding 10 pounds is carried at the boiler and used in the piping system or where such pressure is carried at the boiler and a reducing valve is used reducing the pressure on the system as desired. It is customary with a high pressure system to use a steam trap or pump of one kind or another for returning the water of condensation to the boiler. In our opinion, a steam trap gives better results than a pump. It gets out of order less often, is sure to return the water, and is very rapid. It returns the water at a higher temperature and is economical. The high pressure system where a reducing valve is used on the main and the pressure is cut down or decreased as desired from time to time depending on the weather is, in our opinion, the best system to put in with the high pressure boilers.

And here is a word of advice. Do not copy the heating system that your neighbor has installed simply because your neighbor is satisfied with it. It is possible that he is wasting a considerable amount of fuel and does not know it.

Many times a heating system will work in one greenhouse with a certain kind of boiler and under certain conditions where it will not operate properly in another house almost of the same type and under almost the same conditions. It is the little things in heating that make a difference. One or two air pockets will probably disarrange all your calculations and the system will fail to come up to a standard of perfection. A little turn here or there in the piping, the misapplication of a nipple, or an elbow, or a tee, may cause the entire outfit to do poor work. The boiler may not be properly set, and your mains may not be carried at the right level. As stated, it is the little things that count and, of course, the big things count the same as in anything else.

Just a word about the cast iron boilers for steam heating. We would like to have you read another part of this book describing the boilers and read a letter from one of our customers who has one of our steam boilers. The cast iron boiler is just as good for steam as it is for water and a whole lot better than a large number of so-called Steel Tubular Boilers for greenhouse heating. It will keep steam for as long a period of time, it makes steam at a less cost for fuel, it delivers the steam into the steam mains promptly and directly, it makes steam quicker, and it is far easier to operate. Another thing the cast iron boiler is not likely to explode and destroy your entire plant as is the case many times with the Steel Tubular Boilers.

Moninger Private Telegraph Code

Make Use of this Code

You can save money on your telegrams to us and save time by using code words. It is very simple and you can easily pick out your sentences. Try it on the next message and see how it works out. Answers will often be sent in code words so we can give you full and complete information by wire.

Once you become accustomed to the code method you will use it regularly.

Notice words under each heading begin with a letter relating to the subject, i. e., all words under "Orders" begin with "O," words under shipping with "S," etc., etc.

Length or Width of Houses —Measurements, Number of Pieces, or Order Numbers, or Dollars and Cents

1....Eager	25....Elude	49....Endorse	73....Entwine	97....Exhale
2....Ear	26....Embalm	50....Endless	74....Envy	98....Exhibit
3....Earache	27....Embark	51....Endow	75....Envelop	99....Exhort
4....Earlock	28....Emblaze	52....Enemy	76....Erect	100....Exhume
5....Earmark	29....Emblem	53....Energy	77....Ermine	200....Exist
6....Earnest	30....Emboss	54....Engage	78....Errand	300....Expect
7....Earring	31....Embrace	55....Engulf	79....Escape	400....Expend
8....Ease	32....Emerge	56....Enjoin	80....Essay	500....Expert
9....Eater	33....Emery	57....Enlarge	81....Essence	600....Expire
10....Eaves	34....Emetic	58....Enlist	82....Estate	700....Explain
11....Echo	35....Eminent	59....Enough	83....Esteem	800....Explore
12....Eclipse	36....Emotion	60....Enrage	84....Estrange	900....Expose
13....Eddy	37....Empale	61....Enrapt	85....Evade	1,000....Expound
14....Edge	38....Employ	62....Enrich	86....Event	2,000....Expulse
15....Editor	39....Empty	63....Enroll	87....Evil	3,000....Extend
16....Efface	40....Enable	64....Enshroud	88....Evince	4,000....Exterior
17....Elate	41....Enact	65....Ensign	89....Evoke	5,000....Extinct
18....Elbow	42....Encamp	66....Ensue	90....Ewe	6,000....Extort
19....Elder	43....Enchant	67....Entail	91....Exalt	7,000....Extract
20....Elect	44....Enclose	68....Enthrone	92....Exceed	8,000....Extreme
21....Elfish	45....Encore	69....Entice	93....Exclaim	9,000....Exult
22....Elicit	46....Encounter	70....Entomb	94....Exclude	10,000....Eyelid
23....Elk	47....Encroach	71....Entrap	95....Excuse	.....
24....Elope	48....Endear	72....Entrance	96....Exempt	.....

Boilers

No.	Steam	Water
418	Baby	Bean
518	Bachelor	Bear
618	Badger	Beast
718	Baggage	Beauty
522	Bait	Beetle
622	Bake	Beggar
722	Ballet	Bellow
822	Balloon	Berry
627	Bamboo	Bet
727	Bandanna	Beverage
827	Bandbox	Bird
927	Bandit	Bison

No.	Steam only	No.	Steam only
3130	Borax	3460	Boy
3140	Border	3540	Brag
3230	Boss	3550	Brot
3240	Bottle	3560	Bravo
3330	Bounce	3640	Brave
3350	Bout	3650	Breeze
3440	Bowl	3660	Brevet
3450	Boxer		

No.	Steam	Water
235	Banjo	Blaze
236	Banquet	Blonde
237	Barber	Blossom
238	Bard	Bluff
239	Baritone	Blush
240	Baron	Boar
W. N. 276	Barrister	Bold
W. N. 277	Bassoon	Bonbon
W. N. 278	Bat	Bonnet
W. N. 279	Battler	Bonfire
W. N. 280	Bayonet	Boom
W. N. 281	Bayou	Boost
W. N. 282	Bazaar	Booth

No.	Water only	No.	Water only
4130	Bud	4450	Bump
4140	Budget	4460	Bur
4230	Buffalo	4540	Burden
4240	Bug	4550	Bureau
4330	Buggy	4560	Burly
4340	Bugle	4640	Butcher
4350	Bull	4650	Butler
4440	Bullet	4660	Buzzard

Moninger Private Telegraph Code

Railroads

Code Word	
Dab	Atchison, Topeka & Santa Fe Ry.
Daft	Baltimore & Ohio Ry.
Daily	Chesapeake & Ohio Ry.
Dale	Chicago, Burlington & Quincy Ry.
Dance	Chicago, Rock Island & Pacific Ry.
Dare	Chicago, Milwaukee & St. Paul Ry.
Dash	Chicago & Northwestern Ry.
Dawn	Chicago & Alton Ry.
Daze	Chicago Great Western Ry.
Dean	Chicago & Eastern Illinois R. R.
Deck	Cleveland, Cincinnati, Chicago & St. Louis Ry.
Decoy	Chicago & Erie R. R.
Decree	Chicago & Grand Trunk Ry.
Deed	Chicago, Indianapolis & Louisville Ry.
Deem	Chicago, Indiana & Southern R. R.
Deep	Chicago, St. Paul, Minneapolis & Omaha Ry.
Deface	Chicago, Peoria & St. Louis Ry. of Illinois.
Defeat	Great Western Ry.
Defend	Duluth and Iron Range R. R.
Define	Great Northern Ry.
Defray	Lake Shore & Michigan Southern Ry.
Defy	Louisville & Nashville R. R.
Deity	Illinois Central R. R.
Dell	Iowa Central Ry.
Den	Michigan Central R. R.
Dent	Missouri Pacific Ry.
Deny	Northern Pacific Ry.
Depose	New York Central Lines.
Depute	Pittsburg, Ft. Wayne & Chicago R. R.
Desert	Pennsylvania Lines.
Desk	Pitts,. Cinn., Chicago & St. Louis Ry.
Despite	Southern Ry.
Detect	St. Louis & San Francisco R. R.
Deter	Union Pacific R. R.
Develop	Wabash R. R.
Devote	Minneapolis, St. Paul & Sault Ste. Marie.
Dew	Missouri, Kansas & Texas Ry.
Diary	Mobile & Ohio R. R.

Wrought Pipe

Size	Black Code Word	Galvanized Code Word	Size	Black Code Word	Galvanized Code Word
⅛	Albion		3	Kewanee	Knoxville
¼	Barry	Bement	3½	Lansing	Lemont
⅜	Clayton	Clifton	4	Madison	Mendota
½	Dallas	Decatur	4½	Nashville	Normal
¾	Elgin	Erie	5	Oakland	Oregon
1	Flora	Foss	6	Paris	Polo
1¼	Galena	Geneva	7	Rockford	Rutland
1½	Hamilton	Homer	8	Salem	
2	Irving	Ivanhoe	10	Trenton	
2½	Joliet	Johnson			

Orders

Code Word	
Oar	Add to our order of ..... if it is not shipped.
Oasis	At prices you quoted enter our order.
Obligate	Change routing on our order ..... to .....
Obloquy	Can you cancel order dated ..... without loss?
Obulus	Cancel back orders for .....
Observant	Cannot cancel your order dated.....as it is special and partly completed.
Obstruct	Duplicate our order dated .....
Obtund	Enter order and ship at once.
Occiput	Hold order dated ..... for additions.

Moninger Private Telegraph Code

Orders (Continued)

Code Word	
Occult	Hold order dated ..... for shipping directions.
Ochre	How soon after receipt of order could you ship?
Octopus	Have not received the order (s) referred to.
Octuple	Have you received our order?
Ode	Have you shipped our order dated .....?
Odious	If you have not shipped our order dated ..... hold for instructions.
Offing	If not too late change our order of ..... to read .....
Ogle	Impossible to fill order in time specified.
Ogre	Large part of material on order dated ..... has been made per original specifications and is ready to ship.
Omega	On receipt of order .....
Omen	On your order .....
Onset	Order ..... has been cancelled.
Opaline	Order ..... has been lost or mislaid.
Operate	Order ..... is not clearly understood.
Optical	Order must be shipped complete at one time.
Orange	Order was not received in time.
Orator	Remainder of order.
Orchard	See our order.
Ordain	See your order.
Organ	Send us report of unfilled orders on your books.
Orient	Shall we cancel order?
Ornate	Too late to cancel order.
Orphan	Too late to cancel, order was shipped .....
Ortolan	Unless you can ship in time specified thereon, do not enter order for .....
Osier	We thank you for, and will give prompt attention to, your order dated .....
Ostent	We expect to complete order in about .....
Otto	We have no order from you for .....
Outline	We have entered your order.
Overt	Will send revised specifications by mail.
Ovine	You may fill order with.
Ovoid	Your order will not make quite a car load, what shall we put in to fill up?
Ovule	Your order is being executed and we cannot cancel.
Ovyto	Enter our order and ship all material as per estimate except .....

Buying and Selling

Bagnio	Am (are) in the market for.
Ballad	Are bidding on the same specifications.
Bandit	Are ready to close.
Banter	At what price can you furnish?
Banyan	At what price and how soon can you furnish?
Barbel	Bids are all in.
Barge	Bid is a little too high.
Barite	Bid is much too high.
Barn	Can you do no better?
Barren	Cannot quote without more detailed specifications.
Batter	Do not close without giving us a chance to quote.
Bawl	Do nothing further until you hear from us.
Bay	Does price include.
Bayou	Govern yourself accordingly.
Bank	Have(has) already bought.
Behest	Have written full particulars.
Belay	Have you received our inquiry for price on .....?
Belt	Hold matter open if possible until .....
Benzol	Have you in stock and can you ship promptly .....?
Berate	If not do not enter order.
Beset	Impossible to bid by wire owing to .....
Bestride	Keep us (me) posted.
Bevel	Mail to-day lowest price on.

Moninger Private Telegraph Code

Buying and Selling (Continued)

Code Word

Bilbo .....Prices and terms as agreed.
Billow .....Price quoted.
Bitter .....Prices are subject to change without notice.
Blast .....Quote us by wire lowest prices on .....
Blithe .....Subject to acceptance within.
Bloat .....Subject to immediate acceptance.
Bluster .....We accept your bid of ..... and will mail order.
Bog .....We leave the matter wholly to your judgment.
Bole .....We quote for immediate acceptance.
Bovine .....What yould you suggest?
Bowline .....Will do nothing further until we hear from you.
Braid .....Will quote.
Brandy .....Yes, if you can't do better.
Brent .....You may quote for immediate acceptance only.
Breton .....You may quote for cash.
Brew .....Your inquiry has been referred to.

Credits, Terms and General

Caddis .....Attend to this at once.
Cafe .....Cannot offer any better terms.
Cage .....Cash in advance.
Cairn .....Cash on receipt of goods.
Cake .....Cash on receipt of invoice and bill of lading.
Calash .....Cash in 10 days.
Calcine .....Cash in 30 days.
Caldron .....Cash in 60 days.
Calk .....Cash in 10 days from date of invoice, discount 2%.
Calm .....C. O. D. by express.
Camp .....C. O. D. by freight.
Cannon .....Cannot meet your wishes on terms.
Carat .....Draw at sight.
Card .....Draw at sight with bill of lading attached.
Caress .....Draw on me (us) for
Carnal .....Find out if possible.
Carrot .....From date.
Caste .....F. O. B. cars Chicago.
Castor .....F. O. B. cars at your city.
Casual .....F. O. B. cars at mill.
Catalpa .....F. O. B. cars at mill with a freight allowance per hundred pounds of .....
Caudal .....Have drawn at sight with bill of lading attached.
Cave .....Have mailed check today.
Censor .....Have remitted by mail.
Chant .....How much time do you want?
Chart .....If terms stated are not accepted, telegraph us (me) at once.
Cherub .....Is the offer still open?
Chide .....Net cash.
Choke .....On receipt of bill of lading.
Choler .....On receipt of goods.
Chop .....On receipt of invoice.
Chord .....On the following terms.
Circle .....Prices and terms as agreed.
Clad .....Same terms as last.
Clash .....Six per cent interest added.
Clatter .....Spot cash.
Claw .....Subject to strikes, accidents, and causes beyond our control.
Clean .....Terms accepted.
Click .....Terms are not satisfactory.
Cliff .....Terms are satisfactory.
Clinic .....Usual terms and delivery.
Clock .....What are your best terms?
Clothe .....What shall we (I) do?
Club .....Will give note with satisfactory endorsement.
Cluster .....Will you accept?

Moninger Private Telegraph Code

Prices and Offers

Code Word

Pace .....At what price can you furnish .....?
Pacify .....At what price and how soon can you furnish .....?
Pagoda .....Cannot accept your offer.
Palace .....Cannot quote for immediate shipment.
Pan .....Quote us by wire.
Panda .....Quote us by mail.
Panel .....Quote price in car-load lots.
Pang .....Quote price, in car-load, F. O. B. Chicago.
Papal .....Subject to prior sale.
Pare .....We quote for immediate acceptance and prompt shipment.
Park .....We quote for less than car-load lots.
Parole .....We quote for car-load lots.
Pasha .....We are quoting you by mail.
Patch .....We cannot name prices until we hear from you in reply to our letter dated .....
Pate .....We will figure on.
Path .....We did not figure on.
Patrol .....We do not make.
Patron .....We will guarantee.
Patter .....We will not guarantee.
Pawl .....We thank you, but at the price stated, we cannot accept your order dated .....
Peak .....Wire prices F. O. B. Chicago, and say how soon you can ship.
Pearl .....Wire prices freight allowed to ..... and say how soon you can ship.
Peat .....Your enquiry is not sufficiently specific for us to quote prices intelligently. Please particularize.
Peck .....Prices include freight paid to .....
Peel .....Prices named are very best we can do.
Peep .....Wire price ..... freight allowed here.
Peer .....Wire price ..... Chicago delivery.

Shipping

Sachem .....Advise us of Initial and Car No.
Sacrum .....Are short of cars.
Sad .....Are holding shipment for
Saddle .....Are holding shipment to make up car-load.
Safe .....Badly needed—ship at once.
Safety .....Balance due on order.
Saffron .....Balance due on order was shipped.
Sago .....By what route did you ship?
Sailor..... Can ship all but
Saint .....Can you not do better?
Sake .....Can you ship by the .....
Salad .....Can you ship immediately?
Salam.....Can you ship in time named?
Salary .....Can you state definitely when you can ship?
Salic .....Can you ship by .....?
Saline .....Cannot promise definite time of shipment.
Salify .....Cannot give car numbers until .....
Salix .....Cannot ship before.
Sallow .....Cannot ship in one lot.
Sally .....Cannot ship.
Salt .....Cannot ship for lack of cars.
Salutary .....Cancel shipping directions on order and substitute the following
Samp .....Car left our yards.
Sampler .....Car number.
Sanative .....Change routing on order ..... to read .....
Sanctify .....Consign to ..... in care of .....
Sane .....Did you ship material as promised?
Sang .....Do your best to ship.
Sanguine .....Do not ship.
Sanity .....Do not ship any more.

Moninger Private Telegraph Code

Shipping (Continued)

Code Word
Sanskrit .....Duplicate shipment of .....
Sap .....Do not return shipment. Have written you.
Sapient .....Demurrage will be charged.
Sapor .....Enter order and ship.
Sapper .....Enter order and ship quick.
Saracen .....Entirely out of
Sarcasm .....Expect to ship.
Sardine .....Expect to ship in a few days.
Sarment .....Expect to complete.
Sash .....Expect to ship a part of.
Satchel .....Freight equalized with
Sate .....Freight allowed to destination.
Satin .....Freight rates per 100 lbs. to your city are .....
Satinet .....From receipt of order.
Satire .....Follow instructions in our letter dated .....
Satirize .....Follow original instructions.
Satrap .....Goods shipped to you ..... are still unclaimed. Please give R. R. Agent there, directions for delivery.
Saturate .....Goods are now being loaded.
Saturn .....Get ready for shipment and await routing by mail.
Saunter .....Have you shipped?
Savable .....Hold balance until further advised.
Savage .....How much will you ship?
Savant .....How much did you ship?
Saving .....How soon could you commence shipping?
Savor .....Hurry shipment.
Savoy .....Hurry balance of .....
Sawyer .....Have sent shipping directions by mail.
Scab .....Have telegraphed tracer for shipment.
Scaffold .....Hold for shipping directions.
Scaglia .....Hold for further instructions.
Scald .....How shall we ship?
Scallup .....Initial and car number is .....
Scalp .....If not, do not ship
Scalpel .....If not, ship by .....
Scaly .....If ordered at once, when could you ship?
Scamp .....If ordered at once, can ship promptly.
Scan .....If not already shipped, cancel.
Scandal .....If can't ship at all, ship what is ready and back order balance.
Scant .....If you cannot ship
Scantling .....If you cannot ship at once, cancel.
Scape .....If you have not shipped order dated ..... hold for instructions.
Scar .....If you can't ship in time we specify, telegraph.
Scarce .....Is order ..... to go prepaid freight?
Scared .....Less freight allowance per 100 lbs .of
Scarf .....Let all charges follow.
Scarify .....Must be loaded in same car.
Scarlet .....Must be shipped in one lot.
Scarp .....Must be shipped before.
Scathe .....Must have immediate shipment of order number.
Scenic .....Prepay freight on order.
Scent .....Prepay freight and ship.
Sciatic .....R. R. Co. refuse to accept shipment as routed on your order dated .....
Scissor .....Return shipment, prepay charges.
Scoff .....Return shipment, let charges follow.
Sconce .....Re-ship goods to
Scorch .....Secure lowest possible through rate to
Score .....Send shipping directions at once to apply on order.
Scorn .....Send tracer for shipment of
Scorify .....Shall we ship?
Scour .....Ship by express.

Moninger Private Telegraph Code

Shipping (Continued)

Code Word	
Scourge	Ship by express and prepay charges.
Scout	Ship by express C. O. D.
Scowl	Ship by fast freight.
Scrag	Ship by fast freight and follow with wire tracer.
Scramble	Ship by freight and make sight draft with bill of lading attached.
Scrap	Ship today and reply by wire.
Scratch	Ship by ..... line.
Scrawl	Ship by quickest route.
Scrape	Ship by rail.
Screech	Ship by rail and lake.
Screed	Ship by water.
Scream	Ship by steamer.
Scribble	Ship in care of.
Scrimp	Ship by cheapest route.
Scrip	Ship what you have ready and balance soon as possible.
Scroll	Send shipping directions.
Scrutiny	Ship all you can.
Scuffle	Ship today sure.
Sculptor	Ship in first car.
Scupper	Ship with our order of
Scurf	Ship everything but
Scurrile	Ship not later than.
Scurvy	Shipped all we had ready.
Scut	Shipped all we had in stock.
Sealer	Shipping directions are correct as given.
Seam	Stop all shipments.
Senna	Shipped by mistake.
Sense	Shipment has arrived and is held subject to your order. Amount of charges are .....
Sentry	Shipment checks out short.
Seraph	Too late to stop shipment.
Seer	Too late to change. Car has been billed out.
Serene	Trace by wire shipment.
Serge	Unless shipped at once we will cancel order.
Serial	Unless shipped within ..... we will cancel order.
Sermon	Unless we hear from you to the contrary, we will .....
Serrate	Were shipped by.
Service	Wire initial and car number.
Servile	Wire lowest freight rate on car load and less to
Sever	Wire us initial and number of car, route, and date of shipments.
Sew	Wire shipping date of your order number.
Sex	When will you ship?
Sextile	When will you complete back order?
Sexton	Will do our best to ship.
Shad	Will not be able to ship ..... as promised.
Shadow	Will ship.
Shady	Will ship complete.
Shah	Will ship in first car.
Shale	Will ship within
Shamble	Will trace shipment of ..... as you request.
Shameful	Why do you not ship?
Shampoo	Wanted quick. Telegraph us how soon you can certainly ship.
Shamrock	We can not promise definite shipment.
Shanty	We will ship by fast freight and follow by wire tracer.
Shard	We can ship on .....
Sharper	We can ship on receipt of order.
Shatter	We have already shipped.
Shaver	We hope to ship.
Sheaf	We cannot allow shipment to be returned; have written you.
Sheath	You may return shipment, but freight charge must be prepaid.
Shed	You may return shipment and let charges follow.

Moninger Private Telegraph Code

Telegrams and Letters

Code Word

Tab .....Answer by telegraph quick.
Tabbard .....Answer by telegraph care of .....
Tabby .....Answer by mail.
Tableau .....Answering your letter of
Tablet .....Am (are) awaiting telegram from you.
Taboo .....Am awaiting letter.
Taboret .....Am awaiting reply to my (our) letter dated .....
Taborine .....Await my (our) letter dated .....
Tabular .....Await my (our) telegram.
Tacit .....By return mail.
Tack .....By special delivery.
Tacking .....Call us (me) on long distance telephone.
Tactics .....Explain fully by our code telegram if possible; if not, by letter.
Tag .....Have ordered telegram repeated.
Tailor .....Have replied to your telegram by letter as we cannot cover details by wire.
Taint .....Have found the missing letter.
Talent .....Letter of ..... explains everything.
Tales .....Letter of ..... is not plain.
Talipes .....Letter of explanation mailed.
Tallow .....Mentioned in your letter of.
Talon .....No such word as ..... in our Code. What is it meant for?
Talet .....Replying to your letter of .....
Talut .....Replying to your telegram of .....
Tamable .....See our letter dated .....
Tamarack .....See our telegram dated .....
Tamarind .....Telegraph us at our cost, using our Code far as possible.
Tambour .....Telegraph us at our cost.
Tamp .....Telegraph us shipping directions for your order dated .....
Tamtam .....Was our (my) letter received in time?
Tan .....Was our (my) telegram received in time?
Tandem .....We replied to your letter of .....
Tang .....We answered your telegram of ..... by letter.
Tangible .....What letter do you refer to?
Tangle .....What telegram do you refer to?
Tankard .....Why don't you telegraph?
Tanner .....Why don't you write?
Tannic .....Will await your letter.
Tanrec .....Will send particulars by mail.
Tantalize .....Your letter was not received in time.
Tantalus .....Your letter does not explain sufficiently.
Tantivy .....Your letter cannot be found ..... Please repeat.

Miscellaneous

Magic .....Will be in Chicago.
Magnate .....As follows.
Magnolia .....As soon as possible.
Mainstay .....Badly damaged.
Maize .....Best that can be done.
Majority .....Better send expert.
Malaria .....Can anything be done?
Maltese .....Cannot allow.
Manful .....Cannot make.
Mangle .....Cannot understand.
Mania .....Cannot figure the specifications without having the plans.
Maniac .....Circumstances over which we have no control.
Mansion .....Damage will amount to about .....
Mantel .....Delay at this time will be serious.
Maraud .....Do not mention.
Marguay .....Do not spare any reasonable expense.
Marque .....Do you think it would be well to .....?
Marquis .....Does it (this) meet your approval?
Mart .....Goods are badly damaged.
Marten .....Goods are not damaged.

Moninger Private Telegraph Code

Miscellaneous (Continued)

Code Word	
Martial	Goods are slightly damaged.
Mask	Have (has) ordered goods returned.
Mason	Have you received?
Mass	Have you sent?
Mast	Hold subject to our order.
Mastoid	How long will it take to .....?
Mat	Have no details.
Mattock	It is impossible to
Maturate	It is necessary to
Maugre	It is not satisfactory.
Maw	It is the best we (I) can do.
Mead	If not satisfactory, wire at once.
Meadow	If not too late.
Meander	In a great hurry for
Meat	In accordance with our (my) instructions.
Medial	In reference to.
Meditate	Is (are) being held subject to your order.
Medley	Is it the best you can do?
Meek	Is this satisfactory?
Melior	Is (are) not made for that purpose.
Melt	Let there be no misunderstanding.
Menial	Must have answer by
Merger	Not responsible for
Merle	Objects to clause in contract pertaining to
Mess	On examination (I) we found
Mestiso	Our (my) understanding is that
Meteor	Proposition meets with favor.
Methane	Proposition does not meet with favor.
Mickle	Telegraph your decision.
Mikado	The delay is owing to
Mildew	Think you are decidedly at fault.
Millent	Too late to do anything today.
Minion	Very much disappointed with.
Minor	Very much surprised.
Minstrel	We think you have misunderstood.
Mint	We need architects' plans and specifications in order to quote.
Minuet	We need more definite information in regard to.
Minute	We need further instructions.
Minx	We cannot promise.
Minister	We will complete.
Mirage	We will try to complete.
Missal	What is the trouble?
Moan	Will hold you responsible for
Mob	Will not accept.
Modal	Will send samples of
Mogul	Will you allow?
Moist	Willing to divide the expense
Molder	Without fail.
Monotone	You have omitted
Moot	You may furnish

Estimates

(Figuring on Material)

Code Word	
Fable	Will mail your estimate today.
Factor	Send estimate today sure.
Fade	When will you mail estimate?
Fagot	Can you mail estimate this week?
Fain	Unless estimate is received by ..... cannot consider it.
Fair	Will mail estimate tomorrow.
Faith	Will mail estimate within three days.
Falcon	Cannot estimate until we have more information and are writing you today.
False	Cannot estimate as data given is not clear.
Falter	Wire your estimate giving items separate using your code, and at our expense.

Moninger Private Telegraph Code

Estimates (Continued)

Code Word	
Fame	If estimate is accepted at once when can you ship complete?
Famine	When can you ship material listed in your estimate?
Fan	When can you ship first car of material if estimate is accepted at once?
Fancy	Can ship all material listed in our estimate, three to five days.
Farce	Can ship all material listed in our estimate in 8 days to two weeks.
Fasten	Can ship all material listed in our estimate in three weeks.
Fated	Can ship all material listed in our estimate in four weeks.
Favor	Can ship one carload of material in our estimate in two or three days.
Fear	Can you lower your bid by changing construction?
Feast	How much would estimate be increased if iron frame and truss construction be used in place of semi iron?
Feather	How much would estimate be increased if iron frame flat rafter construction is used in place of semi-iron construction?
Federal	How much would estimate be reduced if iron frame and truss construction is used in place of iron frame flat rafter?
Feeble	How much would estimate be reduced if semi-iron construction is used in place of iron frame and truss?
Feed	How much would estimate be increased if iron frame flat rafter construction is used in place of iron frame and truss?
Fellow	How much would estimate be reduced if semi-iron construction is used in place of iron frame and truss?
Fence	Estimate cannot be reduced by changing construction.
Fern	Estimate cannot be reduced, for we sell at one price only, to everybody.
Felt	Estimate is F. O. B. Chicago, cannot allow freight as this would be the same as reducing figures and we sell at one price only.
Ferry	Estimate is F. O. B. your city full freight allowed.
Fervor	Estimate is F. O. B. Chicago, but we can ship part of material from a factory near you and save some freight.
Fetch	Material in estimate weighs about ..... lbs. The minimum carload is 36,000 lbs. Can you add enough to make carload and save on freight?
Fever	We estimate the freight on all material at .....
Fiber	Send another copy of your estimate.
Fiction	Send estimate by special delivery.
Fiddle	Do not send estimate, we are mailing new specifications.
Fidget	Estimate has not reached us.
Fiery	No plans were received with estimate.
Fight	Estimate received but we need more information. Can you have someone call on us.
File	Estimate wanted on construction material only. No heating system estimate required.
Film	Estimate wanted on heating system only, no other figures required.
Filter	Send estimate on steam heating system for houses in your bid.
Final	Send estimate on hot water heating system for houses in your bid.
Finger	You did not send estimate on all material asked for. Refer to correspondence.
Fire	Refer to correspondence and write us more fully in reply to our questions.
Flag	Wire estimate giving total price without heating system.
Flake	Wire estimate giving total price including heating estimate.
Flame	Estimate on hot water heating.
Flank	Estimate on steam heating.
Float	Estimate on boiler only.
Foam	Estimate on pipe and fittings only.
Folk	If we order as per estimate how soon can you mail plans and ship material needed to start with?
Folly	Can mail plans in ..... days.
Forge	Can ship material to start with in ..... days.

Vertical Refrigerating Machinery

Fig. 704

THE small ice machine is as surely replacing the use of ice in the refrigerator as the large machine has replaced it in the packing house, and for precisely the same reasons. It is possible to preserve meats and provisions indefinitely by mechanical refrigeration, whereas icing, even for short periods of time, is unsatisfactory, as the lowest temperature obtainable (40°) is too high, the variation (from 40° to 50°) too great, and the air too moist, due to the inevitable presence of melting ice.

The proper unvarying temperature necessary for perfect preservation (32° to 34°), can only be secured with an ice machine, refrigerated pipes and surfaces collecting frost, which is congealed moisture taken out of the air.

Refrigeration costs less than half as much as ice, stops all loss by decay, requires no labor, teaming or replacing, and guarantees independence of the ice crop, the dealer and the weather.

Ice is too costly and inefficient. Mechanical refrigeration is colder, cleaner, drier, more economical and convenient, in fact better in all respects, insures better goods, hence a better trade and better prices.

Refrigerating Machinery

Single Cylinder Ammonia Compressor

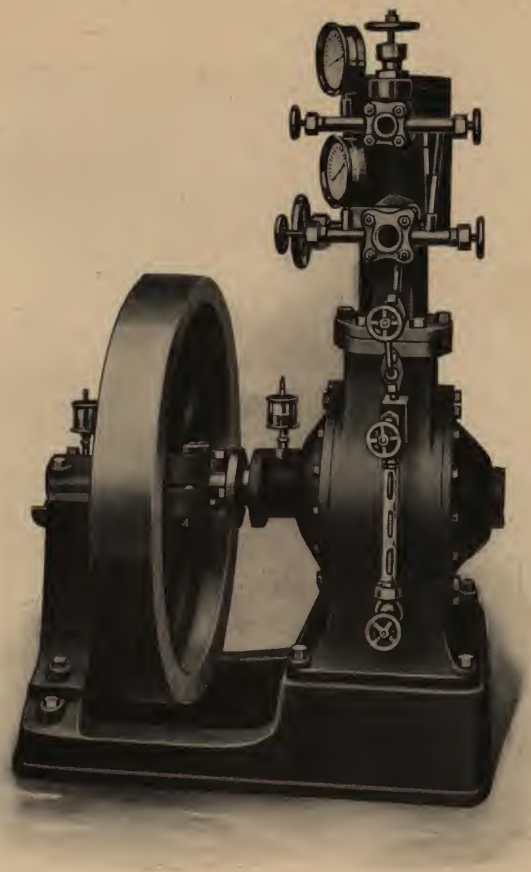


Fig. 705

Owing to the ever increasing demand for a small compact refrigerating plant and the pressure brought to bear upon us by enterprising dealers who come in contact with this demand, we have put on the market a single and a twin cylinder machine described herein.

CONSTRUCTION.

In designing these machines, we have endeavored to make them as simple, strong and efficient as possible, but in no particular can it be found where we have sacrified either material or labor to cheapen our product. There are numerous small machines now on the market selling at prices representing amounts less than our cost, but it is a well-known

Refrigerating Machinery

Twin Cylinder Ammonia Compressor

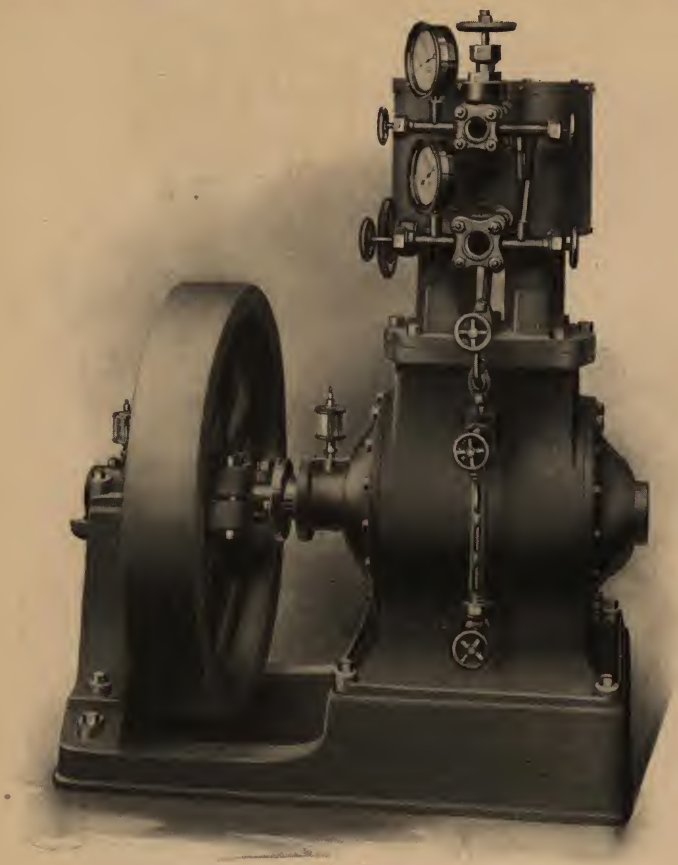


Fig. 706

fact that these extremely low priced machines last but a few seasons. Naturally, the cost of repairs is enormous and within a short time the machine is discarded.

We use the same material and employ the same skilled labor in the construction of these machines as in our large units and they are covered by the same liberal guarantee.

TEST.

Each part of our machine is given a rigid test and careful inspection before being passed on to the assembling department. We are then positive that every part will perform the duty for which it is intended and the entire machine must necessarily be a success. But to be doubly

Refrigerating Machinery

Sectional View of Twin Cylinder Compressor

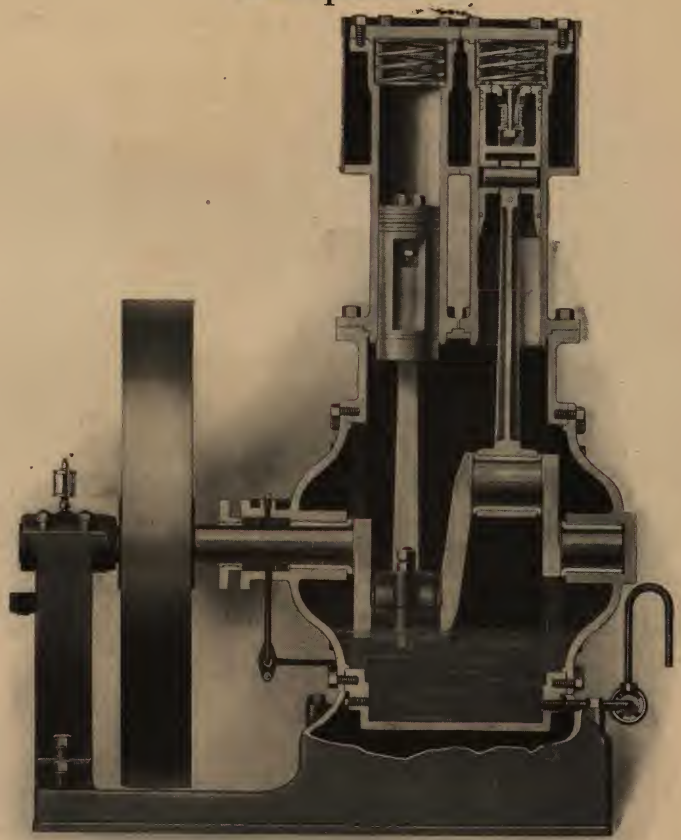


Fig. 707

sure, the assembled machine is put on a testing block connected to a test plant and operated under varying conditions for three days. This gives the purchaser the assurance of having a plant not an experiment but one that has been tried, found perfect and will give the maximum service and satisfaction.

CONDENSER, ETC.

Our standard type of Double Pipe Ammonia Condenser, shown on page 368 is used in connection with these machines and it is thoroughly tested to 400 pounds air pressure under water and guaranteed tight at that pressure. All fittings are of our heavy duty pattern, known throughout the world and reputed to be the standard of all ammonia fittings.

Refrigerating Machinery

Plant Connected to Cold Storage Room

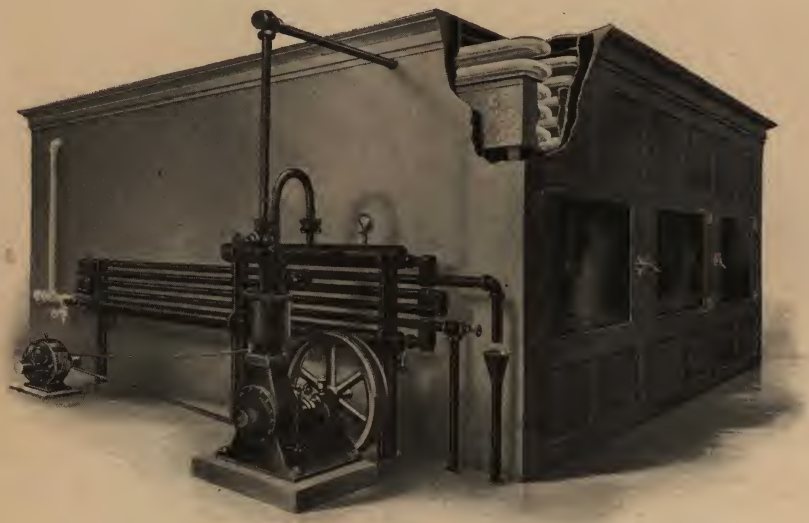


Fig. 709

Showing another method of placing the refrigerating plant, the intention in each case being to save as much space as possible.

On pages 368 and 369 is shown a plant installed in the basement, but it can be placed in any convenient location—above the cold storage room, in an adjoining building or small outhouse.

We recommend motor-driven plants wherever current is available, but our machines can be driven equally well by gas, gasoline and steam engines; also from a line shaft where power is required for other purposes.

Refrigerating Machinery

Plant Connected to Meat Box

Fig. 710

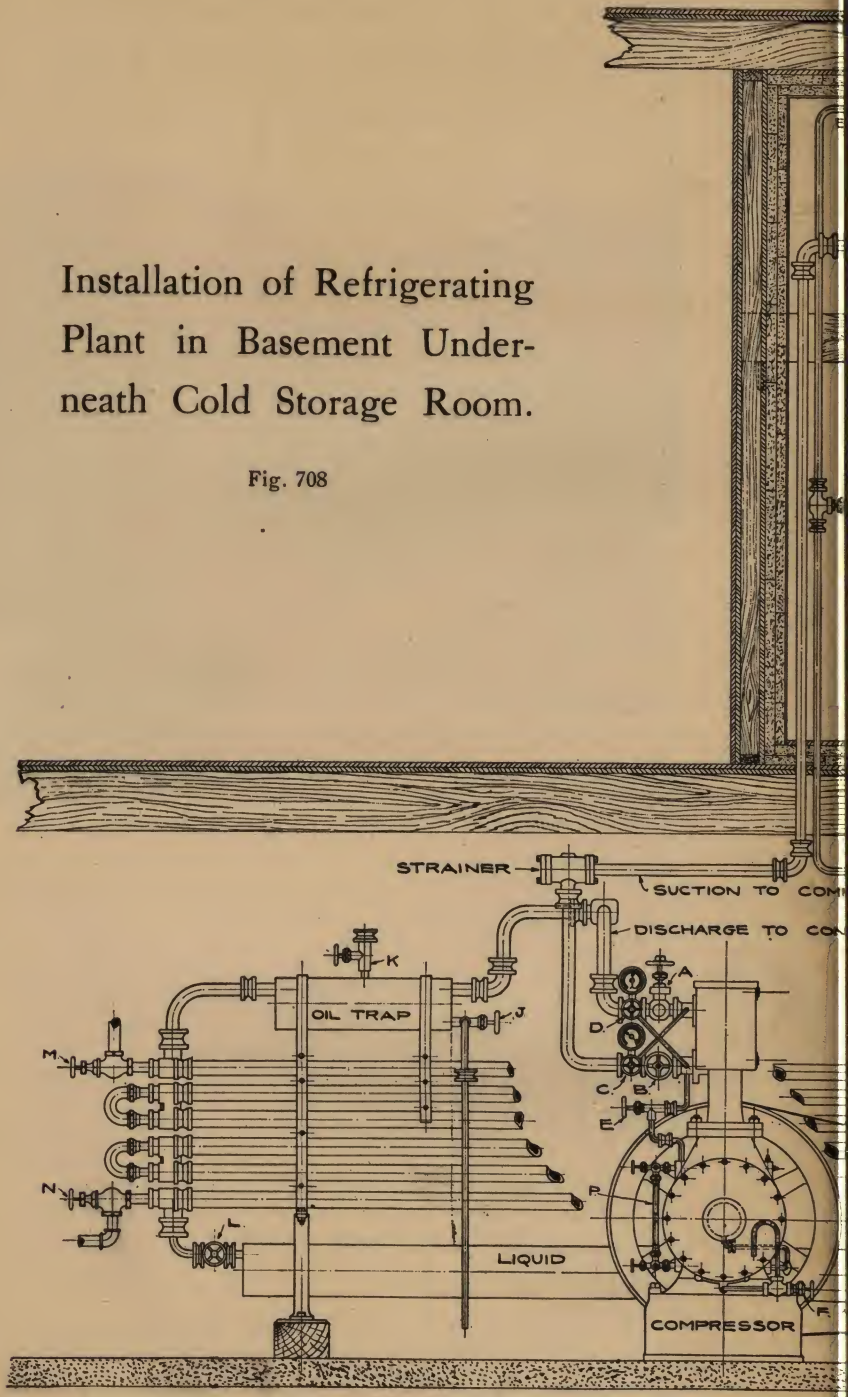
This cut gives an idea of how little floor space is required for our refrigerating plant. In this instance, the space used was that occupied by the Compressor (36 in. x 52 in.), the condenser standing against the wall, with the motor parallel and about 3 ft. from it.

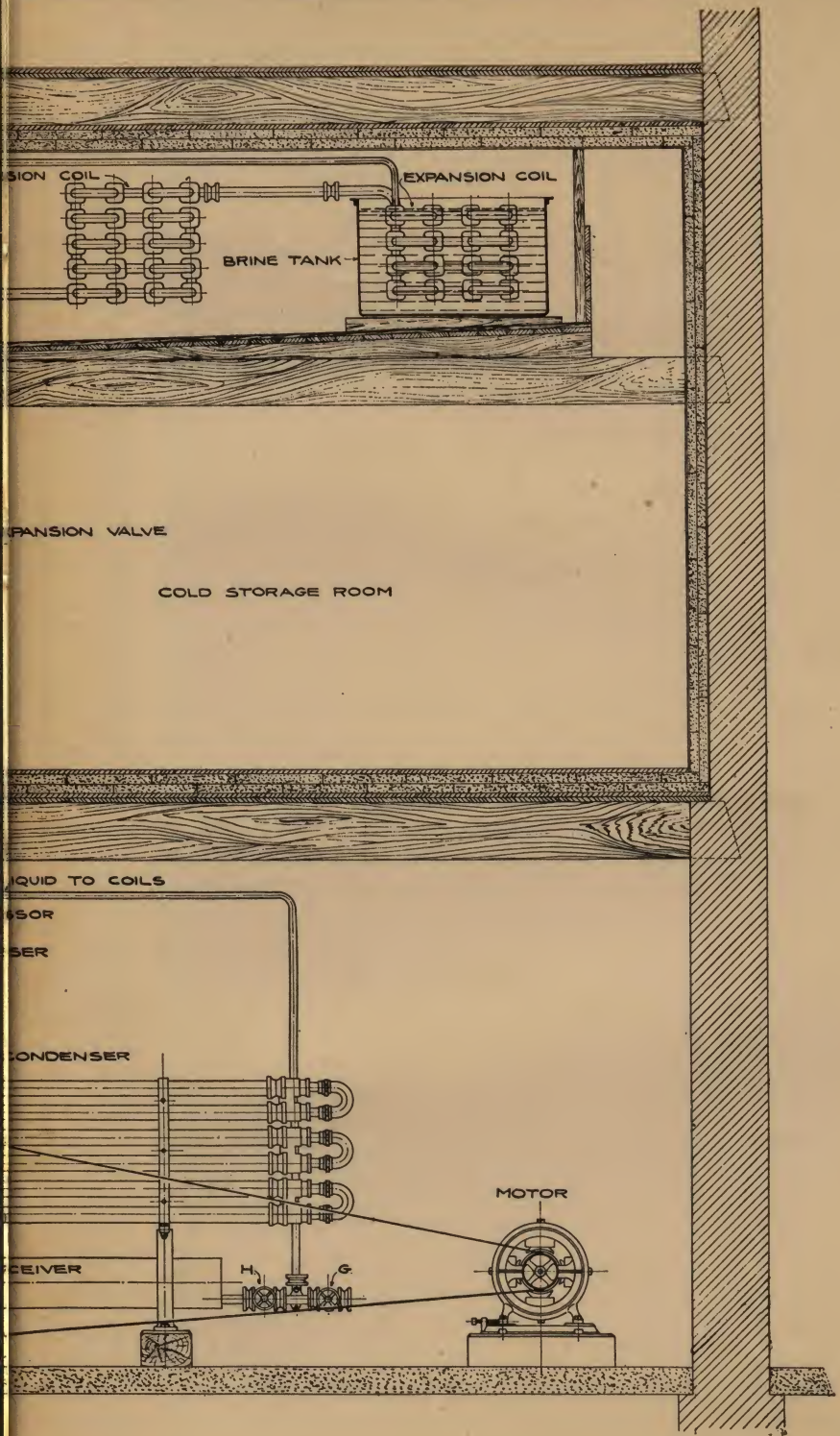
The regulating valve (expansion valve) is shown at the front of the refrigerator, near the electric light switch. This valve controls the amount of liquid ammonia allowed to enter the cooling coils, and as it is all that requires regulating, is always located in a convenient place. The remainder of the plant may be placed anywhere, saving the floor space for other purposes.

A motor is the ideal power, being clean, noiseless, occupying a small floor space, and requiring but little attention.

Installation of Refrigerating Plant in Basement Underneath Cold Storage Room.

Fig. 708




SION COIL
EXPANSION COIL
BRINE TANK
PANSION VALVE
COLD STORAGE ROOM
QUID TO COILS
SOR
SER
ONDENSER
CEIVER
H
G
MOTOR

Specifications of Vertical Single and Twin Cylinder Compressors

CYLINDERS: Semi-steel, cast singly and in pairs, bored accurately to size and tested before assembled.

CRANK CASE: Semi-steel, provided with end plates containing stuffing box and main bearing. A scale pocket is also provided for trapping any scale which might enter the crank case preventink it from being carried up into the cylinder by splashing of the oil.

FLY WHEEL: One 6-arm fly wheel is furnished of generous size, split hub, key seated and faced for belt.

GAUGES: Standard automatic gauge cocks and glass. One high and one low pressure gauge with readings from 0 to 300 lbs. and 30-inch vacuum to 120 lbs. respectively. A temperature scale is also printed on each dial.

PISTONS: Semi-steel, provided with four specially ground steel rings and made exceptionally long to prevent uneven wear of the cylinders due to side thrust. Pistons have ports on each side, to admit gas at the beginning of the downward stroke and gas is also admitted to the cylinders over the top of the pistons, as may be seen on the cut, (page 365.)

VALVES: It can readily be seen that the discharge valve is of the simplest design possible, being only a circular forged plate held in place by a spring of sufficient strength to obtain the required compression, but not so stiff as to cause pounding. The possibility of valve parts breaking and falling into the cylinders is entirely eliminated.

The suction valve is placed in the piston head and is provided with a safety stop to prevent its falling into the cylinder. The stems and discs are of the finest forged steel, set in steel housings.

CONNECTING RODS: Drop forged steel connecting rods with extra large bearings insuring long life with very little wear and adjustment.

CRANK SHAFTS: Like the connecting rods the crank shaft is forged and machined accurately, making all parts interchangeable. In no other small machine will parts be found of such generous proportions and fine workmanship.

STUFFING BOX: A deep stuffing box is used and equipped with the very best grade of packing. An oil connection is made to a lantern in the stuffing box kept full of oil by pressure in the crank case.

Our standard type of condenser is used in connection with this machine, likewise all fittings throughout the plant.

Instructions for Charging and Operating Wolf Single Acting Vertical Ammonia Compressors

1. After the plant has been tested with air and found tight it becomes necessary to remove all air that remains in the expansion coils, condenser, liquid receiver, etc., before charging with ammonia. This is accomplished in the following manner:

Open all valves on the ammonia system excepting "A," "C," "D," "F," "G," "J" and "K," and remove the ¼-inch pipe plug from the gauge tee between valve "A" and the compressor cylinder. This allows the air to be discharged direct to the atmosphere.

2. Open valve on the water line to water jacket of compressor cylinder and start the machine, allowing it to run until the suction gauge located between valves "C" and "D" shows a vacuum of from 26 to 28 inches, or until no air is discharged from the ¼-inch opening, when the machine should be stopped and the ¼-inch plug immediately inserted and made tight. A good quality of ammonia oil should now be admitted to the crank case of machine in the following manner (and until it shows glass gauge "P" about one-half full): insert the goose neck pipe attached to valve "F" in a pail of oil and carefully open valve "F" allowing the oil to be drawn in until a sufficient quantity has been admitted, but during the operation do not allow oil to become so low in the pail that air will be admitted.

3. Remove the blind flange from the valve "G" and connect the valve on ammonia cylinder to it with a short piece of pipe and so placed that the cylinder has a pitch of about two inches in its length. Now open valves "G" and "A" and close valves "H" and "E." Now see that the water valve "N" is fully open and valve "M" sufficient to let the water flow freely through the condenser; the valve on ammonia cylinder may now be opened slowly and when the low pressure gauge shows about 15 lbs. pressure the machine should be started and valve on ammonia drum adjusted to hold suction pressure at about this point until the ammonia is exhausted from the cylinder, which is indicated by frost forming on the under side of the cylinder and about four to eight inches from the valve end. When cylinder is empty close valve "G" and valve on ammonia cylinder, disconnect empty cylinder and repeat the operation if more ammonia is required. Then close valve "B."

4. TO OPERATE THE PLANT:

Adjust expansion valve so that it has a small opening and start the compressor, always being sure valve "A" is open, and that water is circulating in condenser and water jacket of compressor. Open Valve "B" slowly until the full suction opening is obtained; watch the low pressure gauge and when it shows about 15 lbs. pressure open valve "H," allowing the liquid ammonia to be expanded into the coils through the expansion valve; this valve should be adjusted to maintain a suction or low pressure of about 15 lbs., or sufficient pressure that the suction line will frost nearly to the compressor.

5. SHUTTING DOWN:

Close valve "H," allowing the compressor to run until the low pressure gauge shows from five to ten lbs. pressure, when the compressor may be stopped; close valve "B" and "N."

6. TO REPACT SHAFT:

Close valve "B" and open valve "E," let machine run two or three minutes, shut down, close valves "E" and "A," when you can repack the shaft, or replenish the oil supply in crank case.

7. TO PURGE THE CONDENSER OF AIR OR FOUL GASES:

Shut down the compressor and allow the water to flow through condenser for about one hour, when the gases can be discharged by connecting a pipe or hose to valve "K," inserting the end in a pail of water and slightly opening valve "K." The presence of air and gases is denoted by a crackling sound as it enters the water and diminishes as the pure ammonia gas flows from the pipe.

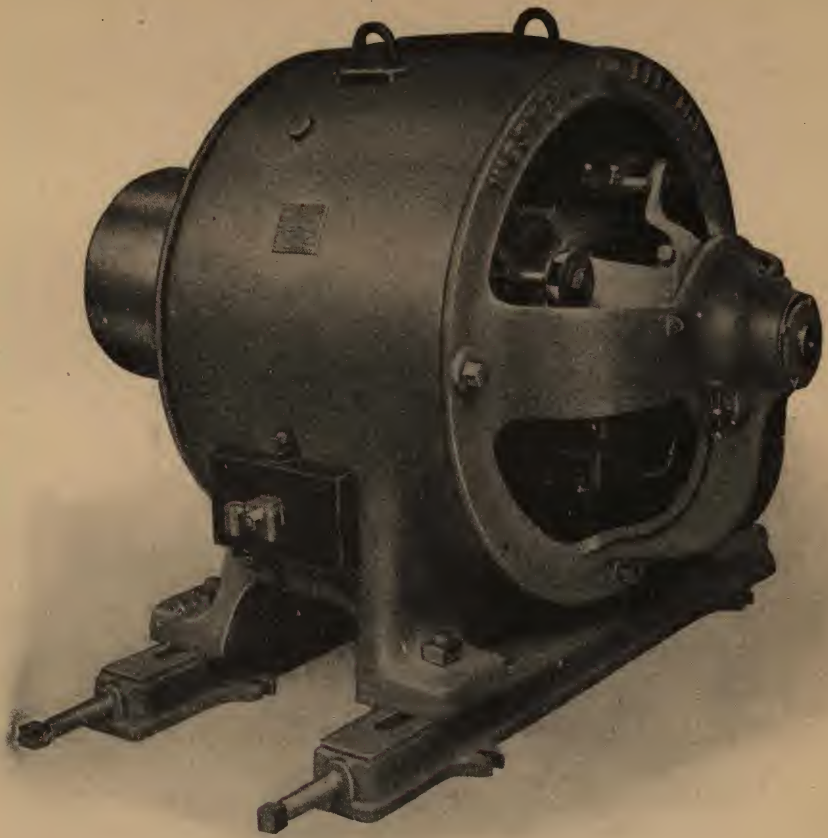
8. TO DRAW OFF THE OIL:

Place pail or other receptacle under pipe from valve "J" and open slowly, allowing it to remain open until all the oil is exhausted. This operation should be repeated as often as necessary. In other words, oil should not be allowed to accumulate in such quantities in the oil trap that it will be forced through the condenser and to the expansion coils as it there forms a thin film and reduces their cooling capacity.

9. An excessive pressure on the high pressure gauge denotes condenser water too warm or insufficient quantity, foul gases or air, or an overcharge of ammonia.

10. An insufficient charge of ammonia is denoted by having to open expansion valve more than ordinarily to maintain suction pressure and the absence of frost on expansion coil.

Write us or our nearest representative for complete information covering your requirements.



Type "E" Motors.

Shunt Wound. "E" Design.

Our "E" design forms our standard line of multipolar motors and has been designed to meet all the various conditions of service demanded of first-class machines. They are of the bracket-bearing type and, by the addition of suitable covers, can be totally enclosed, or, by the use of gride, protected from mechanical injury. They can be back geared, arranged for vertical operation for mounting either on the floor, wall or ceiling, and are especially suitable for direct machine drive. The pole pieces are of the best laminated sheet steel, securely bolted to the frame. The armature is built up of the best grade of carefully annealed and japanned sheet steel, and thoroughly ventilated. The commutator is of hard drawn copper and the design throughout is the best that long experience and careful attention to details can produce. During construction, each part is thoroughly tested, and in addition, each machine as a whole is tested on completion. They are practically noiseless in operation and are so designed that with the brushes once adjusted they will withstand wide variations of load without sparking and without overheating. The design also permits the machines to take heavy overloads without injury

110-Volt Shunt Motors.

Horse Power	Speed R. P. M.	Shipping Weight	Horse Power	Speed R. P. M.	Shipping Weight
1½	475	440	5	590	805
1¾	455	490	5	435	1005
2¾	465	580	5¾	1000	580
3	1025	440	6	1480	490
3	785	440	7	540	1005
3½	700	490	7	395	1495
4	1520	440	9	485	1415
4	975	490	9	380	1525
4	650	580	10	1325	580
4	465	805	10	960	805

INSTRUCTIONS FOR ERECTING GREENHOUSES

IN GENERAL

It is our hope that the result of carefully following these rules will be more perfect and building. To this end we have gathered together a lot of information, part of it from our own experience and part of it from the experience of builders who have for years made a specialty of greenhouse building. These instructions are not intended to cover the minute details of construction, for such a set of rules would probably confuse the builder. It is our idea to give a few general rules that will act as guide posts and aid you in the work.

It is our hope that the result of carefully following these rules will be a more perfect and a more satisfactory greenhouse. Use your good judgment as you go along and you will not go far wrong. If you discover any "tricks of the trade" or if you get on to a certain "knack of doing it" let us hear from you. We will apprceiate the information.

THE GROUND SITE

If your greenhouse is to be built on a light sandy soil it will hardly be necessary for you to put in any drainage, as the water will be absorbed very quickly by the soil, but if your house will rest on a clay or rock soil, you should first assure yourself of proper drainage before any building is erected. Bear this in mind before you build.

Should your houses be built on a hill side, it will also be necessary to have a drainage system, as otherwise the house which is the lowest will always be full of mud and water.

To get proper drainage, dig a trench two feet deep and place in it a 3 inch drain tile, filling up the trench with stones, clinkers or gravel. Do not fill the trench with clay as you would in draining a field, as it will not permit the water to flow away quick enough. This tile can be connected at one end of the houses to a cross drain which empties into whatever receptacle you may provide, or into the coal bin if you have no better place.

HAULING AND SORTING MATERIAL

1st. When you start to haul material be careful to check boxes, bags, bundles, barrels, and pieces with your bill of lading. This is important. If there is a shortage have freight agent mark the shortage on your freight bill. Don't neglect this for otherwise you cannot get refund from railroad. Also be sure to note any damage done to goods and have it marked on freight bill by agent.

2nd. After goods are at your place check every item with the list that we sent you. Claims for shortage must be reported in 5 days to be allowed. Don't wait until you are building to write for shortages. Check it up now and get everything in shape for building. It will be time saved in the end so take the time now.

3rd. As soon as everything is sorted and checked store it away in a safe place where it will not be stolen or lost. Many items are lost or misplaced in the confusion and hurry of building. A good plan is to store fittings and small items in boxes, barrels or bags with a list of contents attached to each package.

PAINTING

1st. New woodwork should be painted as soon as possible after you receive it. Use a thin paint for the first coat with plenty of boiled linseed oil and not much turpentine. Brush it out well. Directions for using our famous greenhouse paint will be found on each package. If you cannot obtain Moninger paint the next best thing is straight white lead and oil with just enough turpentine to dry it. Don't buy cheap white lead. The good stuff costs on an average of 8 cents per lb. If you can't depend on your local man write us about the paint.

2nd. For a second coat on new woodwork use Moninger paint juts as it comes in the can. Brush it out well for this makes it last longer and go further. Don't save on "elbow grease" or you will do a poor job. This is very important.

3rd. Old woodwork when repainted requires various kinds of treatment depending on the age of the wood and the length of time since last painted. It is always better to have the paint too thin rather than too thick. For woodwork that has not been painted for 6 to 10 years a coat of oil only is best for first coating.

4th. All ironwork of every kind should be painted. For iron gutters, purlin supports, purlins, heating pipe, etc., it is best to use our celebrated Metal Kote paint for first coat. Over this coating use our white greenhouse paint. Metal Kote almost doubles the life of all iron and steel.

5th. A coat of paint is always in order in a greenhouse, both inside and out, as it preserves the wood, keeps iron posts and purlins from rusting, and makes the houses light, bright and good as it was when new. The money you invest in paint is well spent every time. Three coats of paint will save you money in the end and we recommend that you do not fail to use plenty of paint.

All of the heating pipe, iron pipe supports, iron work and fittings of all kinds should be painted and kept painted at all times. The idea that steam pipes do not radiate as much heat when painted as otherwise is all nonsense and you will find that they not only give as much heat, but that the house is lighter when they are painted. The pipe supports, where they pass through the benches, should be protected as they will rust at that point if not covered.

Some growers merely wrap a piece of paper around the pipe where it passes through the bench and others put two halves of a flower pot around it. You can also put a small piece of 2" tile around the pipe, and it will be protected for years.

Paint your pipes everywhere, as it gives light to the house and light means life to the plants. A smooth surface is always a better conductor of heat than a rough one, and if your steam pipes are painted in the summer time you will find it a paying investment.

FOUNDATIONS AND WALLS

The most important part of any structure is its foundation, and everyone should be careful with this part of the work. If you purchase the very best material for the superstructure of a building and put in a poor foundation, you will have trouble later on. The use of a little care and good common sense in putting in a foundation for a greenhouse will save you much time and money for repairs later on. If you will follow the simple instructions given in this small article, you will not go far wrong in your work, but we believe will gain much that makes for a properly constructed and substantial foundation and greenhouse wall. It is not the aim of this modest paragraph on foundations and walls, to lay down a set of rules which everyone must abide by, but to give a little instruction as to what are the essential parts and the general method of construction, leaving you to adopt other methods as to details, or use your own ideas in conjunction with this.

One thing should be borne in mind always,—if gutters are used on any wall, whether wall plates are used on other walls or not, the wall and entire house must have a fall of 6 inches in 100 feet, to insure proper drainage. If you use wall plates exclusively on all the walls and you never contemplate the addition of another house, the structure can be built perfectly level. Where

gutter is used on one wall and wall plate is used on the other, the house should have a fall just the same as though you had gutters on both walls. Strict attention to this rule is necessary.

Posts in greenhouses are the true foundation and they should always be of good quality. Walls and foundations may be classed in three general divisions: Wood posts and walls; pipe posts and wood walls, and brick, stone, concrete or walls of similar construction. Concrete is more generally used for foundation than any other material as it forms a good base for any style of wall, whether iron pipe, cast iron or wood post, or brick or stone.

WOOD POSTS AND WALLS

As before stated, the posts of a greenhouse form its foundation and they should be carefully selected for their durability and strength. Do not use common white cedar posts when you can get a red cedar, nor a 6 inch round post, when a 4x4 would be sufficiently large and strong enough. Tennessee red cedar posts are the best to use and the most durable. If the red cedar posts are good, they will last as long as any other part of the structure, presuming, of course, that they have been properly set. The wood posts should be painted in all cases and in no case should they be coated with tar, as it is injurious to plant life. If you use the cedar squares, they should be dressed on four sides, especially where side glass or sash is used, which will give the wall a much neater and better appearance, to say nothing of the ease in painting. If the common round white cedar, tamarack or locust posts are used, be sure to have a slab off on one side so that the sheathing can be properly nailed to same.

PIPE POSTS

To meet the increasing demand for better wall material, iron was introduced and has proven very satisfactory, so much so that iron posts of pipe are now used almost exclusively in modern up-to-date structures. This form of construction is lighter, neater and casts less shade than any other construction for walls yet devised. The durability of this kind of wall over wood is very little if you use the Tennessee red cedar posts, but it is far more satisfactory. This wall construction is especially of advantage when sash or stationary glass is used in the side walls or dividing walls. The posts are set much in the same way as the wood posts, except that care must be taken to see that the tops of posts are all the proper height. Wood posts are cut off at proper place after set but the pipe posts must be set correctly and care should be used to have them the right height from the ground in all cases. If gutters are used on any wall, the house must have a fall of 6 inches in 100 feet, and this fall must be arranged for with the posts when they are set. If eave plates are used on all the walls the house will set perfectly level, provided you do not intend to add other houses later, and in this case the posts should be arranged of even height throughout the length of the house.

To get these posts in line, we recommend that a wood post be set up at each end of the house and that you then measure the proper height at each end, allowing for gutter or plate as the case may be, nailing a strip of wood, at the point you decide on, to each post, just as described in paragraph on post setting. After you have put these strips on you can begin to set the posts and when the top of post is level or in line with the top edge of strips over which you are sighting you can set it securely and move on to the next post. See that the posts are set true and perfect with the aid of two lines, one at the top and one at the bottom or with a spirit level.

Pipe posts should be masoned into concrete walls at the time wall is built. If you are using wooden wall be sure to bring the concrete footing about four inches above the surface of the soil and taper it up to the post. This protects the post. Concrete walls are usually made eight inches thick.

HOW TO SET POSTS

There are several ways of setting posts but to get them all in line perfectly, lengthwise and crosswise, the following method has proven most satisfactory.

1st. Get your line for the wall. Measure off the length of the house and set up a wooden post or stick at intervals of about 50 feet. Make a straight edge about 10 feet long to use for sighting. Get a 2 foot spirit level. Measure height of wall on highest end of the house and mark post. Hold straight edge against post, get it level and sight for level on the next post you have set up. Mark this post. If your house is to have a fall measure down from the mark the amount of the fall (3 inches in 50 feet is enough) and mark again. Now stretch a line from one post to the other, one at the top and one at the bottom.

2nd. Measure distance apart posts are to be set and commence on the post holes.

3rd. Dig post hole a few inches larger and deeper than is necessary, so that the extra space can be filled with concrete. After concrete is placed around the post, tamp it down solid until the water begins to come to the top. Finish the top concrete so that it extends about 6 inches above the ground and tapers to the post as this prevents decay and rot at the point where post enters the soil. Be sure to set the posts perfectly straight and true with the aid of two lines, one at the top and one at the bottom, or with a spirit level. If concrete is not used, a stone or a few brick should be placed at the bottom of post hole so as to give the post a firm foundation. In setting wood posts, it is not necessary that the tops should be all of even height, as they are afterwards to be cut off at proper distance from the ground.

4th. Posts should be set so they line up both ways, the length and the width of the houses. To get a square corner after first line of posts is set measure a distance of eight feet along the length of the houses and drive a stake. Be sure this first stake is directly in line with the posts. Now measure a distance of six feet across the width of the house and drive a stake. The distance from one stake to the other across the corner should be 10 feet. This will make a triangle. If distance between stakes is over 10 feet the line across the gable is too far out and if less than 10 feet it is too far in.

If cast iron gutters are used you must lay these out in runs before you set the posts. At every post fitting mark place for post and set it according to the gutter.

For wood gutters and plates, channel iron gutters or angle iron eave plates set posts according to plans.

After posts are set attach your gutters or eave plates. Do not finish walls until after the roof is all up.

GUTTERS AND EAVE PLATES

Whenever gutters are used on any walls, whether exclusively or in connection with wall plates, they must have a fall of 6 inches in 100 feet, or a drop equivalent to that. If you have a wall plate on one wall and a gutter on the other, the both walls must have a fall. This amount of fall for gutters is sufficient to insure proper drainage at all times, and you will find, if care is used in this matter, that no trouble will ever be experienced as far as drainage is concerned.

In connected houses, gutters serve a three fold purpose as they serve to carry off the water from roofs, as a walk for repairing broken glass and as a means whereby the sash bars are attached and held in place, therefore it is necessary that every gutter be properly supported and properly made in every way.

WOODEN GUTTERS AND PLATES

Always let the wooden gutter project six inches or more beyond the end of house and by making a saw groove an inch or two deep, inserting in this a piece of tin a few inches broad, the water will be thrown clear of the building at all times. This method is to be applied only where it is not necessary to save the water for further use, but the gutter should, in all cases, project beyond the end of the house a little.

If you wish to save the water from gutters, be sure and tap them about two feet from the end, and put in your down spouts. Never place a down spout outside of the house, as it is a nuisance in every way, especially in the winter when it closely resembles a miniature iceberg. If it is desired, or the houses are very long, the down spouts can be placed at intervals of about 75 feet, or if the houses are very wide and also long, the down spouts can be closer.

If your walls are to be sheathed up to the gutter or plate, a groove will be made by us into which the first sheathing will set. If stationary glass is used, the glass sill will have a groove for the sheathing and the gutter will be grooved for glass. In putting up the gutters, be sure that you get the proper groove on the right side of the house. The gutter with sheathing groove must be placed on the wall where you use the sheathing, and the one with glass groove or for sash hanging rail, must be put where it belongs.

Be sure you get this right when you put up the gutters or there will be trouble. You can readily tell where your gutter or plate belongs by looking at the groove. Where sash are used in the walls, we will furnish a sash hanging rail and the gutter will be properly grooved to receive it, but where sash and stationary glass is used in the same wall alternately no sash hanging rail will be furnished or will be necessary, the sash being hinged directly to the gutter or plate and ordinary window stops used in place of the hanging rail.

With pipe posts, the wood gutter or wall plate is secured to the posts with cast iron hubs and screws, all of which will be funrished you with the other material. Where wood posts of any kind are used, it will be necessary to drive three 20d spikes through the plate. Drive these nails in staggered relation to each other, so as not to split the wood.

Be sure to use plenty of thick white lead at every gutter splice and then nail them together with six 8d common nails for each.

After gutter plate is secured to posts the sills are then nailed on using 16d barbed nails and placing one every 12 or 14 inches. The sill splices are white-leaded and then nailed with three of four 8d common nails. The drip for gutter or wall plate, if you have that pattern, is not nailed on until the bars are in place, as it is liable to be broken off during building. To properly secure the drip moulding a 10d finishing nail should be driven directly through it into the sill. Some carpenters use a small nail and drive it through the drip conductor through into the sill, but this is not nearly as satisfactory as the method described above. The long 10d finish nail will hold the drip in place and prevent it from being easily broken off.

Care should be taken to set gutters on the posts properly so that there will be room enough for the sheathing, glass or sash as the case may be. If in doubt as to how much projection to give the gutter or plate, refer to your blue print and get the inside measurement of house. If you know the outside measurement of house from the outside to the outside of wall, or measurement center to center of posts, the inside measurement will tell you how much the gutters or plates will project on each side of the posts. In nearly every case, we supply full size details for the wall construction, so that no mistake will be made. The gutter or plate line is probably the most important part of the greenhouse in its construction and a little thought while you are erecting will save much time and trouble. Eave plates are handled in much the same manner as the gutters.

IRON GUTTERS AND PLATES.

This kind of gutter or plate should never be placed directly on top of a brick, concrete, stone, cement block or tile wall as, in the first place, the contraction and expansion of the iron would crack the wall and, in the second place, the purpose of the iron gutter is to keep the snow and ice from the roof which it could not do if placed directly on the wall. Side sash or stationary glass should always be used with iron gutters if you have a wall as mentioned above. Pipe post or wood post walls can, of course, be sheathed up to the gutter as the heat from the house will have a chance to heat the gutter from inside and in turn melt the snow and ice. All statements to the contrary, the iron gutter does expand and contract and they must be put up carefully to avoid any trouble from this source.

We furnish, where iron gutters are used, a gutter top rail to fit the style of gutter used, arranged for sheathing, stationary glass or side sash. The joints of iron gutters are filled with cement and the bolts should be dipped in cement to make the joint water tight.

The sash bars are attached to iron gutters and eaves with sash bar brackets. Fasten bracket to gutter first and then screw it to the sash bar. Details of brackets will be found listed in catalog under greenhouse fittings.

The post hubs on gutters allow a slight amount of adjustment up and down. In this way you can get the gutter in perfect line.

Be careful to get downspouts in the right place. They should be about 75 feet apart.

Be sure to notice how the various runs of gutter are to start and get the right end of the house for the start. This is shown on the plan. If in doubt write or wire us.

Iron gutters are furnished with cast iron plates to close the ends. Channel iron gutters are drilled at the end so you can fit in the plate and close the channel.

RIDGE AND SASH BARS.

After gutters or plates are in place you are ready to begin work on the roof. The ridge should be supported, one piece at a time, on "carpenter's horses," or a temporary frame work,

After you have the ridge in place temporarily, nail a sash bar to it and to the gutter sill or wall plate, at the same time, if possible.

After the first two bars are on (one for each slope of the roof) at one end of the ridge, you make a templet or pattern long enough to cover seven or eight bars. This pattern must be exact and should reach from center to center of the number of sash bars you wish to cover. After this pattern is made you commence putting on the other bars, using two header pieces to space them, one at the ridge and the other at the plate line. As soon as you have the number of bars nailed which your templet covers, measure and see that there is no variation due to the nails drawing the ends. It is possible in nailing the bars that the person nailing at the ridge will draw the bar one way and the one who is at the eave line, will draw it in an opposite direction, therefore, the templet or pattern for measuring them. When the ridge splice is reached, four 8d common nails are driven in to hold it, and the work of putting on the sash bars is continued to the end. One 8d finish nail is driven in through each side of the bar just above the drip groove, on each end directly into the sill

or ridge. Be careful to set all the sash bars SQUARE witn the gutter sill or eave plate and give the RIDGE same FALL as the GUTTER. The entire house, when finished, should lean to one end—which ever way the gutters or plates fall.

In putting on the sash bars care should be used to have the glass bed on the same line with the groove for glass in the ridge and the sills. This is important. Be sure that you allow $\frac{1}{8}$ inch for glass play between every sash bar wherever used—no more or less. If any of the bars seem a trifle short, which is sometimes the case, due to shrinkage of the wood, save them until the end of the house is reached when they can easily be used by lowering the ridge just a little. The matter of the gable rafters, and how they are to be placed will be dealt with under the heading of Gable Ends. If your ridge is the pattern with cap, the cap is nailed on after bars are in place, using one 16d barbed nail every 14 inches.

Whatever you do, remember, that all bars are to be set on the square with gutter or plate. Also be sure to allow $\frac{1}{8}$ inch play for glass.

HEADERS AND VENT SASH.

First ascertain where the headers are to be nailed, using a vent sash as a measure; then nail the headers securely using 8d common nails. The first nail is driven directly through the side of sash bar into the end of header and the next one is "toe nailed" through the other end of the header into the bar.

If your vent sash have caps, nail it on before you put up the sash, also put the hinges on all sash before you put the ventilators in place on the house. Vent sash cap is nailed on with 8d nails; one every 14 inches. When putting on your hinges, count how many you have and allow the proper amount for each sash so that there will be no shortage caused by placing too many to a sash. The sash will be properly beveled for pitch of roof. Put plenty of paint on the ends of headers before nailing them in place.

GABLE ENDS.

The gable rafters can be set square with the gutter or plate if desired and in that case you will not be obliged to cut the last row of glass on roof. If the gable end bars are set plumb, the last row of glass must be cut to fit. Some florists prefer setting the gable end bars plumb so that door-frames and doors will be vertical, but we have found that setting them square is just as satisfactory, and that much labor is saved thereby. After your gable end bars are in place, you can set up the door frame at whatever point you want the door. It is not necessary to set the door and frame exactly in the center of the gable end as it can be placed at whatever point is most convenient for you, opposite a walk or in a place where you can enter the boiler room, if on that end. After the door frame is up put on the gable plate.

If you have both walls sheathed up to the eave line set your gable plate on a line with the gutter or eave plate. Where you have stationary glass or side sash put the gable plate on the same level as the glass or sash sill—we will furnish you enough gable end bars and other material for the construction that way. You can now put in the vertical gable end bars, using a mitre box to cut off the upper ends. The gable end bars are nailed the same as the side bars used in stationary glass. Use 16d barbed nails for the gable plate, three at every port. For the door frames, use 20d spikes, 20 of them being required for each door frame.

In setting the posts for gable ends, have one on each side of the door frame and space the others evenly between door frame and the corner. Where stationary glass or sash is used in side wall, corner bars will be furnished. Four 8d common nails are used to nail corner casings.

STATIONARY GLASS IN WALLS.

The glass sill should be placed level, the same as the eave plate, or it should have the same fall as the gutter, whichever you use. The side bars should be placed according to the size of glass you will use, allowing $\frac{1}{8}$ inch for play. After the first sheathing is put on, a layer of parchment paper (do not use tar paper) is placed over it and you are ready for the novelty siding for outside.

Where the walls have stationary glass, or it is used in any wall, the gable plate should be in line with it. Stationary glass in walls is constructed just the same for pipe or cast iron post walls as it is with the wood walls, excepting that the glass sill and sheathing is nailed to the post blocking in place of the wood posts. Two 16d barbed nails are used to hold the glass sill at each post, and two 8d common nails are placed in the end of each piece of sheathing at the posts. The side bars are held, according to their length, by two 8d or 6d finishing nails at each end. Where stationary glass is very deep, an extra 6d finishing nail may be driven through the tongue of bar into glass sill. The glass sill is grooved for the sheathing, and this should be properly fitted in when you are erecting the house. (For corner casings, gable rafters and gable plate, see paragraph on "Gable Ends.")

SASH IN WALLS.

The post setting for side sash often varies and you should consult your plan to see if any special directions are given. The sash sill and the sheathing is handled in the very same manner with this construction as with the stationary glass in walls. After gutter is complete, the sash hanging rail is nailed on using 8d finish nail for the purpose and placing one every 12 or 14 inches. The sash dividing strips are placed wherever the sash meet, and then nailed to the sash sill and hanging rail, gutter or plate, with an 8d finish nail, two in each end. The side sash are glazed and painted before set in place, and generally not hinged to the hanging rail until everything else is finished. The hinges are generally attached to the sash first, and then the sash are put in place.

BENCHES.

Bench construction is very simple and we believe the illustrations in our catalog will make this clear to you. Refer to estimate, or copy of order, for style of bench to be used and you will find specifications as to size of pieces for legs, cross pieces, stringers, bottoms and sides, also lengths to be used.

GLAZING.

The glazing of the greenhouse is very important, and you should be sure to use the very best strictly pure putty, as otherwise your lapped glass will be a source of annoyance if poorly laid.

Our standard putty or our special liquid putty is the safest article. Get it and you are sure to have the right article. Don't buy from the paint store as this class of putty is unfit for greenhouse work. Don't take any chances on this glazing as it is a vital matter and you must use a high grade putty.

Run the putty along the bar between the thumb and fingers like a small rope or by holding a mass of it in your hand fill the glass rabbett by scraping the palm of the hand across the rabbett. Bed the glass down tight in the putty so that it rests on a firm, solid bed. See that putty spreads out evenly over the entire surface of the rabbett on the bar.

Drive in your glazing points. Use one on the end of the light at each side and one on the top of the light at each side, making four points at one end of each light. Start glazing at the eave and finish at the ridge. Any small pieces used should come at the eave line. Breakage is more liable to occur at the eave and the small lights are easy to replace. Four points to each light are all that will be required unless the pane of glass is over 24 inches long, when an additional point on each side should be used in the center.

After glass is laid in several rows scrape putty off on the underneath side, using a putty knife on a stick. Save this putty you scrape off as there is a considerable quantity in even a small house. Use it with the other putty.

If liquid putty is used you should have one of our glazing machines or a rubber bulb. The machine is best. Fill machine or bulb with putty just as it comes from the can and run spout along the bar. Be careful to squeeze out just enough putty to make a bed for the glass as the excess cannot be saved. See instructions on the can before using.

If you want to use standard putty in the machine or bulb thin it, according to temperature of the weather, with linseed oil until thin enough to press through the spout like a ribbon or rope.

In laying any glass, be sure to have the rounding side up and the thin edge, if any, should be laid facing up the bar.

REMINDERS

Be sure to get acquainted with the names of all the parts of the greenhouse. Study the catalog.

Keep everything in a safe place.

Don't leave fittings, bolts, screws, etc., around amongst the rubbish that is always present where building is going on. This will result in a loss to you.

Study your plans carefully. Go over them in detail and get it all pictured in your mind before you start.

Read the instructions two or three times until every point is clear.

Don't try to use fittings or other material that is not proper pattern. If we have shipped something different than your order calls for notify us at once, and we will make good. We cannot allow any bills for labor, for repairing or making over material. We agree to make good any mistakes in shipping and for any defective material but the measure of damages in no case shall be more than the price of such defective goods. Bear this in mind and always notify us first before doing anything.

INSTRUCTIONS PECULIAR TO SEMI IRON HOUSES

About the only items in a semi iron house that differ from the general instructions are the pipe purlins and the wire trusses.

With pipe purlins we furnish a special split coupling that is clamped on the joint. No threads are used. Either split tees or steel purlin clamps fasten the purlin to the support. These split tees or clamps clamp the pipe and are held by bolts. Galvanized pipe straps hold the purlin to the roof bars.

Be careful to scale your plan and place purlin at proper place. Fasten purlin to the roof bars before the house is glazed. Now set the purlin supports in concrete footings. Be sure to brace roof so that there is no sag. Attach purlins to the supports and you are ready to glaze. Refer to catalog for illustrations of the split tees and the clamps. If clamps are used in place of the split tees the purlin support must be drilled. The purlin clamp is bolted through the pipe and prevents slipping. The split tee clamps the pipe only and is not bolted through the support.

WIRE TRUSSES.

Wire trusses are very largely used in all kinds of greenhouses now, and they are a great aid to keeping the roof perfectly in line. The truss is made of No. 8 galvanized wire and turn buckles are used to draw it tight. The wire is attached at the gutter or plate line to one of our wire plates screwed to the bottom of plate or gutter. The wire is then carried over to the purlin at the point where the support is placed and then on over the other purlin, where it is cut off about half way between gutter and purlin. Your turn buckle is now put on and the screws are let out full length, so that you will have just a little slack in the wire. Now turn your turnbuckle until the wire is good and tight. If you have a ridge support or double Y and a purlin on each side, wrap the wire around the center supports where it crosses. The wire trusses are usually placed at every other purlin support and we figure material for them that way.

INSTRUCTIONS PECULIAR TO COMBINATION IRON FRAME AND TRUSS HOUSES

Refer to general instructions.

Refer to instruction blueprint attached to plans.

Refer to catalog for illustrations

1st—Setting of Posts

Set all posts in concrete allowing them to project the proper height above ground as shown in blue prints. Be sure to get them nicely in line and that they are all plumb. Allow a fall of 6″ in 100 feet for wooden gutters and 4″ for iron gutters, lengthwise of the house so that gutters will drain properly. See to it that the posts are set the proper distance apart center to center across the width of the house as trusses positively will **not** fit unless posts are set properly. All posts must be directly opposite across the width of the houses so that trusses will be nice and straight. Note the holes at upper ends of posts and see that these all run lengthwise of the house.

You can now fasten on the post collars using the long center bolt only.

2nd—Where Iron Gutters Are Used.

The spacing of the posts lengthwise of the house is determined by the gutters themselves as the hubs are cast directly to the gutters. You must have the iron gutters on the ground before you can set posts.

3rd—Where Wood Gutters Are Used

The spacing of the posts is determined by the plans furnished with each job.

4th—Where Owner Furnishes Posts

The owner must procure 2″ pipes, and drill $\frac{9}{16}$″ holes clear through at the upper ends, the distance from the top being shown on the full sized details furnished with each job.

All previous instructions as to setting posts must be followed.

5th—Where Trusses Connect to Houses Already Up

Drill $\frac{9}{16}$″ holes clear through the present 2″ pipe posts taking care to have the holes run in the direction of the length of the house. The distance from the top is shown on the full sized detail furnished with every job.

6th—Putting on Gutters

After posts are set and post collars are fastened, the gutters should be put on. If wood; care should be taken to get plenty of **thick** white lead in all joints and splices. If iron; the joints should be carefully cemented with thin Portland cement.

7th—Trusses

All trusses will be shipped in two parts (one part for each side of house) already put together except tie rods and ridge plates. The ridge plate however will be found fastened to one part of each truss.

8th—Setting Up Trusses

Lay each side of a truss flat on ground near posts the truss is to go on and fasten together at ridge plate with two ½" bolts and nuts and two nuts on rods. Then slip the tie rod through strut plates placing two nuts on each outside end of rod. You are now ready to put the trusses on the posts and will need some scaffolding.

The simplest scaffolding we know of consists of three wooden horses each with 6" or 8" saddle and about 10 feet long. The center one high enough so that a man can easily reach the ridge and the two side ones of a convenient height. These horses can be moved along as the work progresses.

Set up the first truss on the second posts from the end and brace it well. Then set up the second truss on the third posts from the end. Now put on the ridge and all the purlins. Continue in this way to the end of house. No truss is used on the last set of posts. Set all trusses in the square with gutters and not plumb.

Right Here!! Let us impress you with the necessity of firmly bracing the trusses so that they cannot fall endwise of the house. The trusses are a mountain of strength **after the greenhouse is all up and glazed** but before this they must be well braced so that they cannot fall endwise of the house.

9th—Fastening Sash Bars on Wood Gutters

Sash bars are fastened to wood gutters at lower end with two 8d finish nails, to the purlins with a bar clip screwed to sash bar and at upper end with two 8d finish nails. The lower ends of all sash bars are cut to fit at our factory but the upper ends must be cut on the job. Only those sash bars under the outside stiles of roof vents run clear through to the ridge, the others extend only to the headers.

10th—Fastening Sash Bars on Iron Gutters

The sash bars in this case are fastened in the same way with the exception of the lower ends which are fastened with a steel gutter bar clamp instead of being nailed on.

If the roof of the greenhouse is uneven span these gutter bar clamps are of different shapes and before shipping will be tagged: "For Flat Pitch"; "For Steep Pitch."

11th—Roof Ventilator Sash

The roof ventilator sash are not always as shown in the instruction blueprint but they are always properly shown on special full size detail sheet furnished with each job.

12th—Warning!

Don't fail to properly brace trusses endways of the houses during erection. It will not take a very strong wind to blow them all down unless they are braced. After the **houses are glazed** and finished there is not the slightest danger and all braces may be taken down.

INSTRUCTIONS PECULIAR TO IRON FRAME FLAT RAFTER HOUSES

Refer to general instructions.
Refer to catalog for illustrations.
Study your plans carefully.

1st. Take particular pains to see that good concrete properly mixed is used for all foundations. That all walls, etc., are of the thickness and depth and height as shown on the blueprint plans. Where the soil has been filled in, the foundation should be carried down to the firm footing below.

2nd. In setting up steelwork see that all columns and posts are vertical and of the proper heights. All steelwork must be perfectly straight.

3rd. See that all bolts, nuts and screws are drawn up tight.

4th. All woodwork must have two coats of paint before it is set up. Steelwork must have one coat of paint before erection, and one coat after it is set up.

5th. The wooden caps or F. R. C. sash bars must be firmly seated upon the steel flat rafter and the clips which hold it in place must be attached properly.

6th. Be careful to have gable end braces properly attached and firmly imbedded in concrete.

7th. In glazing see that there is plenty of putty put in the rabbets of sash bars, that the glass is pressed down firmly and that the putty is scraped off on the inside. This putty should not be wasted, but saved and used again.

8th. In erecting steelwork if truss is used in center see that the tie rod has two nuts at each extremity.

9th. When setting up steelwork **be sure** to brace it well so that the wind will not blow down the arches. After the greenhouses are completed everything will be perfectly strong and rigid but before the buildings are finished they should be braced well on account of the wind.

10th. Be sure that all pipe supports are firmly imbedded in concrete footings and where the ground has been filled in the pipe supports should extend down to the solid soil below.

HOW TO USE GALVANIZED NAILS

Gutter Sills one 16d Barbed every 12".
Splices each two 8d Common.
Gutter Plates three 20d Common at each post. Splices six 8d Common each.
Drip Mouldings one 10d Finish every 12".
Roof Sash Bars Wood Gutter four 8d Finish each bar
Roof Sash Bars Wood Gutter two 6d Finish each bar
} If Iron Gutter is used..... { 2—8d Finish / 1—6d Finish } for each bar
Side and Gable End Bars four 8d Finish and two 6d Finish each.
Ridge Cap one 16d Barbed every 12". Splices six 6d Finish each.
Sash sill, Glass sill or Gable Plate one 16d Barbed every 12" or figure two for every post. Splices 4—8d Finish.
Door Frames each 20—20d Common.
Corner Casings—6—20d Common.
Corner Bars—6—8d Common.
Wall Coping one 16d Barbed every 12". Splices 4—8d Finish.
Apron one 8d Common every 12".
Sheathing two 8d Common every post for each board.
Wood Purlin one 8d Common each bar. Splices 4—8d Finish each.
Headers two 6d Finish each for new style.
Vent Sash cap one 8d common every 12".
Sash Hanging Rail one 8d Common every 12".
Sash Dividing Strips four 8d Finish each.
Seat Strips one 6d Finish each notch.
Weather Strips one 6d Finish each.
Benches—Style No. 2—
Bench Bottoms 100 sq. ft., 41—8d Common.
Bench Faceboards 8d Common every 12".
Bench Crosspieces each post, 1—20d Common.

INDEX

General Subjects

Item — Page

Greenhouse Construction ..... 11 to 89
Semi Iron Houses ..... 50 to 52
Iron Frame and Truss Houses ..... 53 to 56
Iron Frame Flat Rafter Houses ..... 57 to 65
Construction Details ..... 66 to 92
Chicago Ventilator Lifter ..... 93 to 99
Moninger Ventilator Lifter ..... 100 to 109
Hot Bed Sash ..... 110 to 116
Glass ..... 117 to 118
Putty ..... 120 to 121
Paint Materials ..... 122 to 125
Water Supply Systems ..... 126 to 127
Engines ..... 128 to 138
Pumps ..... 139 to 160
Water Supply Outfits ..... 162 to 163
Handy Data on Pumping ..... 167 to 177
Boilers, sizes etc. ..... 179 to 202
Radiators ..... 203 to 217
Boilers, how to erect, etc. ..... 219 to 242
Pipe, Fittings, Valves, etc. ..... 243 to 333
Tools ..... 293 to 311
Useful Information on Heating ..... 334 to 351
Telegraph Code ..... 352 to 361
Refrigerating Machinery ..... 362 to 372
Instructions for Eelecting Houses ..... 374 to 379

A

Acme Hose Coupling 288
Air Cocks 292
Air Required for Combustion 343
Air Valves 291
Altitude Gauges 328
Ammonia Compressors ..... 360 to 371
Angle Valves, Brass ..... 272 to 274
Angle Valves, Iron ..... 280 to 282
Armstrong Threading Tools 296
Asbestos Cement 318
Asbestos, How to Cover Boiler 342
Asbestos Pipe Covering 319
Augur, Bits 302
Augurs, Post 304

B

Barnes Pipe Cutter 299
Beam Hooks 269
Bemis & Call Wrench 301
Benches, Wooden 78
Benches, Pipe Frame 79
Bibbs, for Hose 290
Blocking Clamps 74
Boilers, Description of ..... 179 to 189
Boilers, 18"-22"-27" Series ..... 190 to 191
Boilers, 230 Series ..... 192 to 193
Boilers, 270 Series ..... 194 to 195
Boilers, Economy of Batteries 218
Boilers, How to Blow Off 244
Boilers, How to Cover with Asbestos 342
Boilers, How to Erect ..... 219 to 238
Boilers, How to Select Size 243
Boilers, Measurements of ..... 196 to 199
Boilers, Repairs Price List ..... 245 to 246
Boilers, Round Type ..... 200 to 202
Boilers, Sense Boiled Down ..... 239 to 242
Boilers, Showing Battery Connections 190
Braces, Carpenters 302
Branch Tees 268
Bronze and Liquid 333
Brushes, Bronzing 327
Brushes, Flue 327
Brushes, Paint 123
Brushes, Radiator 327
Bucket Traps 316
Bushings 266
Butterfly Valves 311
Cap, for Sash Bar 82
Cap, for Vent Sash 84
Caps, Cast Iron 266
Caps, Malleable Iron 267
Capacity, of Pumps 169
Casing, Dimensions of 169
Ceiling Plates 270, *331*
Cement, Asbestos *318*
Cement, Boiler 318
Cement, Smooth-on 318
Check Valves, Brass Standard 274
Check Valves, Brass Swing 275
Check Valves, Iron Swing 283
Chicago Ventilator Lifter ..... 93 to 99
Chicago Ventilator Lifter Price List 99
Chimney Flues ..... 325 to 326
Circulators for Hot Water 329
Clamps, Ideal Pipe 306
Coal, Average Weight of 346
Coal, Heat Value of 345
Cocks, Air 292
Cocks, Bibb for Hose 290
Code, Telegraph ..... 352 to 359
Coil Stands 269
Combustion, Air Required for 343
Coping, Wall for Glass 84
Coping, Wall for Sash 85
Cost of Greenhouses 66
Couplings, Hose 287
Couplings, Hose 288
Couplings, Malleable 254
Couplings, Malleable R & L 267
Couplings, Malleable Reducing 267
Couplings, Wrought Iron 254
Covering, Asbestos Pipe 319
Crosses, Cast Iron 260
Crosses, Malleable 260
Cutters, Pipe, Barnes 299
Cutters, Pipe, Saunders 299
Cutters, Pipe, Toledo 295

D

Detroit Steam Traps 315
Door Hardware 76
Door Stop 84
Double Glazing Bars 82
Down Spouts 76
Drills, Automatic 303
Drills, Chain 304
Drip Gutters, Wooden 73

E

Earth Augurs and Diggers 304
Eave Plates, Angle Iron 61
Eave Plates, Wooden 73
Eclipse Reducing Valves 286
Elbows, Cast Iron 255
Elbows, Drop 259
Elbows, Malleable 256
Elbows, Side Outlet 259
Elbows, Union for Radiators 275
Electric Motors 372
Engines ..... 128 to 138
Expansion Joints 316
Expansion Tanks 330

F

Fittings, Greenhouse Structural ..... 71 to 89
Flange Unions 261
Floor and Ceiling Plates 270
Floor and Ceiling Plates 331
Floor Flanges 267
Flue Brushes 327
Flue Cleaners 327
Fuel, Heat Value of Coal 345
Fuel, Values of 346

G

G. Bar 84
Gable Rafters 75
Gable Rafters 83
Gas Pipe Hooks 318
Gate Valves, Brass 284
Gate Valves, Iron 285
Glass 117
Glass Cutters 123
Glass Power of Transmitting Heat 348
Glass Price List 118
Glass Sill 85
Glazing Bulbs 123
Glazing Machines 123
Glazing Points 119
Glazing Putty-Liquid *120*
Glazing Putty Standard *121*
Glazing Strips *81*
Globe Valves, Brass Std 271

Item	Page
Globe Valves, Brass Std	272
Globe Valves, Brass J. D	273
Globe Valves, Iron	279 to 282
Graphite	318
Greenhouse Pipe, Cast Iron	307
Greenhouse Fittings, Cast Iron for Heating	307 to 311
Gauges, Steam	304
Gauges, Vacuum	304
Gutters, Cast Iron	52 to 54
Gutters, Channel Iron	61
Gutters, Moulding for	84
Gutters, Sills for	80
Gutters, Top Rails for	85
Gutters, Wooden	73
H	
Hack Saws	304
Hack Saw Blades	304
Hangers, Pipe	320
Hammers, Claw	302
Headers, for Vent Sash	83
Heat Circulators	329
Heat Generators	321 to 324
Heat Regulators	332
Heat Units in Water	347
Heating Data	334 to 351
Heating Residence	340 to 341
Hinges	76
Hooks for Pipe	318
Hook Plates	269
Hose Bibbs	290
Hose Couplings, Acme	288
Hose Couplings, Standard	287
Hose Nozzles	287
Hose Nozzles	288
Hose, Rubber	287
Hose, Sprinklers	288
Hose, Shut Off	288
Hose, Valves	289
Hot Bed Sash	110 to 116
Hot Water and Steam	349
How to Figure Greenhouse Heating	334
I	
Ideal Chain Wrenches	299
Ideal Pipe Clamps	306
Information on Power Pumping	167 to 177
Information on Heating	349 to 351
Instructions for Erecting Greenhouses	373 to 378
Instructions for Installing Chicago Lifter	97
Instructions for Installing Moninger Lifter	109
Instructions for Installing Power Pumps	165
Instructions for Operating Power Pumps	165
Iron Frame Flat Rafter Houses	57 to 65
Iron Frame Trussed Houses	53 to 56
J	
Joints, Expansion	316
L	
Latches, Door	76
Levels, Spirit	302
Locks, Door	76
Lock Splice	75
Locknuts	266
Locknut Nipples	253
Long Screws	253
M	
Machinery, Refrigerating	360 to 371
Manifolds	268
Menders, Pipe, Ideal Clamp	306
Metal-Kote Paint	124
Minneapolis Heat Regulator	332
Moninger Ventilator Lifter	100 to 109
Moninger Ventilator Lifter Price List	106
Monkey Wrenches	300
Morehead Steam Traps	315
Motors, Electric	372
N	
Nipples, Malleable Iron	253
Nipples, Wrought Iron	250
Nipples, Wrought Iron	251
Nipples, Wrought Iron	252
Non Conductors, Value of	346
Nozzles, Discharge of	176
Nozzles, Hose	287
Nozzles, Hose	288
O	
Oakum	311
P	
Packing, Sheet	317
Packing, Steam	317
Packing, Valve	317
Paint Brushes	123
Paint, Greenhouse	122
Paint, Metal Kote	124
Parmelee Wrenches	300
Partition Strips	82
Pipe Carriers, Hook Plates	269
Pipe Carriers, Moninger	320
Pipe Carriers, Ring and Bar	306
Pipe, Cast Iron	307
Pipe, Covering	319
Pipe Cutter, Barnes	299
Pipe Cutter, Saunders	299
Pipe Cutter, Toledo	295
Pipe Hooks	318
Pipe, Information about	339
Pipe Reamers	306
Pipe, Galv. Straps	318
Pipe, Tools for	393 to 301
Pipe, Wrought, Standard	248
Pipe, Extra Strong	249
Planes, Block	302
Planes, Smoothing	302
Plugs, Cast Iron	266
Pliers	300
Pneumatic Tanks	127
Pneumatic Water Supply	162 to 163
Pneumatic Water Supply, Illustrated	126
Pocket Rules	303
Post Augurs	304
Post Hole Diggers	304
Post Top Fittings	74
Price List Greenhouse Fittings	89
Pumps, Capacity of	169
Pumps, Centrifugal	145 to 152
Pumps, Drop Well Head	153 to 159
Pumps, Forms of Drive	144
Pumps, Handy Data on	167 to 177
Pumps, Pyramid	140 to 141
Pumps, Rods and Couplings	161
Pumps, Triplex	142 to 143
Pumps, Vacuum	139
Pumps, Well Cylinders	160
Purlin Fittings	72
Putty	76
Putty Bulbs	123
Putty Liquid	120
Putty Machines	123
Putty Standard	121
Q	
Question Sheet, Construction Material	67
Question Sheet, Heating System	178
Question Sheet, Water Supply Outfits	178
R	
Radiation for Greenhouses	334 to 339
Radiation for Residences	340 and 341
Radiators	203 to 217
Radiator Bronze	333
Radiator Brushes	327
Radiator Tapping List	217
Radiator Valves	276 to 278
Railing Fittings	270
Reamer, Pipe	306
Receivers for Steam Traps	312 to 315
Reducers, Malleable Iron	267
Reducing Valves	286
Refrigerating Machinery	360 to 371
Relief Valves, Water	303
Return Bends, Cast Iron	262
Return Bends, Cast Iron	263
Return Bends, Malleable	264
Return Bends, Malleable	265
Return Steam Traps	312 to 315
Ridge Cap	84
Ridge Patterns	21
Rods, Wood for Deep Wells	161
Rose Stake Fasteners	306
Rules, Pocket	303

Item — Page

S

Safety Valves 303
Sash Bars 75
Sash Bars, full size.... 81
Sash Bars, full size.... 82
Sash Bars, full size.... 83
Sash Sill, full size.... 85
Saunders Pipe Cutter....299
Saws, Carpenters 302
Screw Drivers 303
Semi Iron Greenhouses....50 to 52
Service Buildings 18
Shelf Brackets 77
Shovels, Scoops 304
Skinner Irrigation System....164
Smooth on Cement....318
Soil Pipe and Fittings....307 to 311
Spades, Drain 304
Splices, Wooden 75
Split Tee ....71 and 72
Sprinklers, Hose 288
Squares, Carpenters 302
Standard Sizes of Greenhouses.... 67
Steam and Hot Water....349 to 351
Steam Gauges 314
Steam, Properties of....348
Steam Traps Bucket....316
Steam Traps, Return....312 to 315
Steel Smoke Stacks....326
Steel Tool Chests....305
Stillson Wrenches 301
Stocks and Dies, Armstrong....296
Stocks and Dies, Screw Plate....293
Stocks and Dies, Screw plate....294
Stocks and Dies, Toledo....295
Storage Tanks 127

T

Tables on Pumping....166 to 177
Tanks, Expansion 330
Tanks, Pneumatic 127
Tanks, Storage 127
Taylor Steam Trap....315
Tees, Cast Iron....257
Tees, Malleable Iron....258
Telegraph Code ....352 to 361
Temperature, Variation of....344
Thermometers, Greenhouse 303
Thermometers, Hot Water....328
Thermostat, Minneapolis 332
Threads, for Pipe....253
Tinned Pipe Straps....318
Toledo Stocks and Dies....295
Tool Chests 305
Tools, Carpenters 302
Tools, for Pipe....304
Traps, Return Steam....312 to 315
Traps, Steam Bucket.... 22

Item — Page

Trimo Wrenches 301
Turnbuckles 71

U

U. Bolts ....74 to 87
Useful Information ....167 to 177
Useful Information on Heating....334-351
Union Elbows 275
Unions, Flange 261
Unions, Malleable 261

V

Vacuum Gauges 304
Vacuum Pumps 139
Valves, Brass Gate 284
Valves, Butterfly 311
Valves, Globe and Angle, Brass....271 to273
Valves, Greenhouse 311
Valves, Hose 289
Valves, Iron Gate 285
Valves, Iron Globe and Angle....279 to 282
Valves, Iron Swing Check....283
Valves, Radiator 276 to278
Valves, Reducing 286
Valves, Safety 303
Valves, Standard Check, Brass....274
Valves, Swing Check, Brass....275
Valves, Water Relief 303
Ventilator Construction ....68 to 70
Vent Sash Cap....84
Vises, Malleable Iron....297
Vises, Toledo 295
Vises, Vulcan Chain 298
Vulcan Chain Wrench....298

W

Wall Coping for Glass.... 84
Wall Coping for Sash.... 85
Water, Heating System....349 to 351
Water, Heat Units in....347
Water, Relief Valves....303
Water Supply Systems....162 to 163
Water, Useful Information on....167 to 177
Wheelbarrows 304
Wrench, Bemis and Call....301
Wrench, Ideal Chain....299
Wrench, Monkey 300
Wrench, Parmelee 300
Wrench, Stillson 301
Wrench, Trimo 301
Wrench, Vulcan Chain....298

Y

Yankee Drills 303
Y Bends, Cast Iron and Malleable....265
Y Brace Construction.... 71

Z

Zero Double Glass Sash....114

INDEX TO FIGURE NUMBERS

Figure No. — Page

23 309
50 }
51 } 250
52 }
53 } 253
54 }
55 } 254
56 }
57 } 255
58 }
59 }
60 } 256
61 }
62 }
63 }
64 } 257
65 }
66 }
67 }
68 } 258
69 }
70 }
71 } 259
72 }

Figure No. — Page

73 }
74 } 262
75 }
76 } 263
77 }
78 } 264
79 }
80 } 265
81 }
82 }
83 }
84 } 266
85 }
86 }
87 }
88 }
89 } 267
90 }
91 268
92 269
93 }
94 }
95 } 269
96 }

Figure No. — Page

98 270
102 270
104 }
105 } 272
106 273
107 }
108 } 274
109 }
110 275
111 276
112 277
114 278
115 275
116 279
117 280
119 281
120 283
121 284
122 285
123 }
124 } 289
129 }
130 } 261

Figure No.	Page
131, 132	260
153	286
155, 156, 157	290
158, 159, 160, 161, 162, 163, 164, 165	291
166, 167, 168	292
169, 170	301
171, 172	301
173, 174	300
176	299
177	299
178	297
179, 180, 181, 182, 183, 184	295
185	330
188	318
189	318
190	267
191, 192	318
193	282
200, 201, 202, 203, 210, 211, 212, 213, 214	308
215, 216, 217, 218, 219, 220, 221	307
222, 223, 224, 225, 226, 227, 228, 229, 230, 232, 233	296
235, 236, 237	298
271	103
334	296
388	51
389	51
390	52
391	52
392	52
393	54
394	**54**
395	54
396	**54**
397	54
398	54
399	55
400	55
401	58
402	59
403	59
404	60
405	60
406	60
407	61
408	61
409	61
410	61
411	62
412	63
413	64
414	65
415	68
416	68
417	69
418	69
419	70
420	70
421	71
422	71
423	71
424	71
425	72
426	72
427	72
428	72
429	72
430	72
431	73
432	73
433	73
434	73
435	73
436	73
437	73
438	74
439	74
440	74
441	74
442	75
443	75
444	76
445	76
446	76
447	**76**
448	76
449	76
450	77
451	77
452	78
453	78
454	79
455	79
456	79
457	79
458	79
459	79
460	80
461	80
462	80
463	80
464	81
465	81
466	81
467	81
468	81
469	81
470	82
471	82
472	82
473	82
474	82
475	82
476, 477, 478, 479, 480, 481	83
482, 483, 484, 485, 486, 487, 488	84
489, 490, 491, 492, 493, 494, 495	85
496, 497, 498, 499	86
500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520	**87**
521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551	88
522, 553, 554, 555, 556, 557, 558, 559, 506, 561, 562, 563, 564, 565, 566, 576, 568, 569, 571	90

Figure No.	Page
572, 573, 574, 576, 577, 578, 579, 580, 581, 582, 583, 584, 586	91
587	93
588, 589, 590, 591	94
592, 592½, 593, 594	95
595, 596, 597, 598	96
599	100
600, 601	101
602, 603, 604	102
605, 606, 607, 608	103
609, 610, 611, 612, 613	104
614, 615, 616	105
617, 618	107
619, 620	108
621	110
622	111
623	113
624	114
625	115
626	117
627, 628, 629, 630	119
631	120
632	121
633	122
634, 635, 635, 637, 638	123
639	124
640	126
641, 642	127
643, 644, 645, 646, 647	164
648, 649, 650, 651, 682	287
653, 654, 655	288
656	299
657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669	310
670	313
671	316
672, 673, 674, 675, 676, 677, 678, 679, 687	317
688, 689	320
690	321
691, 692, 693, 694, 695, 696, 697	324
698	305
699, 700, 701, 702	327
703	328
711 to 719	329
720 to 727	331
728	332
789, 790	302
799	303
824½	304
904	305
924	334
971	139
1030	160
1049	142
1319	153
1454	155
1518	139
1531	161
1567	157
3000	159
3003, 3004, 3005	140
	141
	145
	150

INDEX TO ILLUSTRATIONS OF GREENHOUSE PLANTS

B

Bassett & Washburn 11
Bensinger, B. E..... 49
Bohemian Cemetery 21
Boise Floral Co..... 37
Brenner Floral Co..... 37
Bruns, H. N..... 22
Burhop, Walter 12
Butte Floral Co..... 38

C

Cervenka, Jos..... 28
Clinton Falls Nursery Co... 45
Colonial Flower Shop..... 25
Coster, E. J. F..... 47

D

Davidson, Miss L. M..... 49

E

Elms Greenhouse Co..... 26

F

Fair, Frederick 10
Fair, Frederick 49
Fifth Avenue Floral Co..... 26
Fister, John P..... 32
Frache Bros..... 47
French Lick Springs Co..... 24
Frey, C. H..... 36
Frisz, John G..... 25
Frueh, Chas. & Son..... 46

H

Hall, Walter S..... 23
Hess & Swoboda 36
Hirschfeld, Otto 27
Hoerber Bros..... 17
Holton & Hunkel Greenhouse Co. 44

I

Illinois State Normal School. 20
Ives, Byron H..... 35

J

Joy Floral Co..... 41

K

Kansas State Agricultural College 35
Kirchberger, R. S..... 48

L

Lake Newell Floral Co..... 43
Lothrop, C. H..... 29

M

Metairie Ridge Nursey Co.. 42
Miller Floral Co..... 34
Mitchell 46
Moninger Office and Factory 2

N

Northern Illinois State Normal School 20

P

Park Floral Co..... 40
Pikes Peak Floral Co..... 40
Pinchbeck, Wm. 29
Poehlmann Bros. 16

R

Ruetenik, Fred 26

S

Salt Lake Floral Co..... 34
Schiffmann, R. 39
Seitz, Hy. L..... 22
Smith & Young 24
Stuppy Floral Co..... 43
Swanson, Gust 14

T

Tilt, J. E..... 10
Tilt, J. E..... 15
Texas Seed & Floral Co.... 42

U

United States Department of Agriculture 33
University of Arizona 39
University of Chicago 13
University of Kentucky 32
University of Vermont 31

V

Vatter, Geo. 45
Vaughan's Seed Store..... 17

W

Waldheim Cemetery 21
Walla Walla Floral Co..... 38
Weinhoeber E. Co..... 22
Weinschenk & George 30
Weinschenk, W. H..... 30
Weiss, Peter 16
Wendland & Keimel 14
Whitcomb, Geo. G..... 11
Wietor Bros. 15
Wilcox, J. F..... 23

FRED. KLEIN CO., PRINTERS, CHICAGO